

# THE PURGING HYPOTHESIS

The new paradigm for solar system formation,  
solving all SNDM paradoxes while fully  
integrating solar and planetary formation

## ABSTRACT

The Solar Nebular Disk Model (SNDM) is the widely accepted paradigm for solar system formation (SSF). However, this modern variant of the almost 300 year-old 'Nebular Hypothesis' is plagued by an unacceptable number of paradoxes and unsolved issues such as the angular momentum paradox, the formation of terrestrial planets and abundant presence of water.

Suspecting SNDM may be fundamentally flawed, a new paradigm was synthesised via 'Paradox Based Reversed Engineering' under the most challenging design parameters possible:

1. *None* of SNDM's paradoxes are allowed to remain
2. All formation aspects must be consistent with observations, especially the latest footage of Hubble ST, Spitzer ST and ALMA
3. All formation aspects must logically interconnect to provide a solid end-to-end 'story line'.

After nearly 2 years of reversed engineering efforts, gradually a sequence took shape that was able to explain the entire process in the desired flawless way.

### Note for the reader:

*Due to its very nature, this paper is not written in the usual scientific format of hypothesis - data set - analysis - confirmation cycle. The approach has a distinctly different engineering signature which astronomers may not be used to;*

1. *Clean sheet start: All previous theories on SSF are ignored, not falsified*
2. *Acceptance of all observational footage as design requirement input*
3. *Discarding of any and all computer generated simulations*
4. *Analysis of the current top-20 paradoxes and issues: Treating paradoxes as 'indicators of flawed human thinking' allowed for RCA/FMEA failure mode break down analysis exposing each root cause (a flawed human assumption) behind each paradox.*
5. *Application of 'Paradox Based Reversed Engineering (PBRE): Redesigning SSF by carefully navigating around the drivers of all known paradoxes*
6. *Upon completing the targeted avoidance of all paradoxes and issues, only one **-upfront unknowable-** end to end process remained. This, by sheer design logic, ought to be the correct one*

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# Summary

Our current consensus theory for solar system formation (SSF) is the nearly 50-year old Solar Nebular Disk Model (SNDM) with various new hypotheses superseding it on details. Although solid scientific methods were used to justify each alteration, this does not mean they are necessarily correct, nor that the entire consensus SSF construct as such is valid. For this one has to look at:

1. *Logic consistency:* *End-to-end connectivity between all aspects of a SSF model*
2. *Physical consistency:* *The absence of paradoxes*
3. *Observational consistency:* *Consistency with all existing and -above all- new observations (not simulations!)*

When scored on these criteria, our consensus SSF theory, as well as its known alternatives, are all strikingly inadequate. Moreover, recent observations point to ever more inconsistencies, causing top astronomers to admit they may have 'gotten it wrong'. The question next becomes to what extent our consensus theories are incorrect: If only minor corrections are needed, the usual scientific approach of hypothesis, data set, measurement and validation should suffice to inject the needed corrections. If, on the other hand, our consensus theories contain major flaws, then the sensible course of action is to redesign the entire process from scratch. This requires multi-level reversed engineering techniques whereby the outcome –a synthesized new SSF model itself- is inherently **not** knowable upfront. This is no longer the competence of astronomers but of engineers. This paper describes such an approach, including an innovative analysis of our paradoxes, resulting in a twofold source for design requirements:

1. All astronomical footage available anno 2018, focussing on accretion disks, jets and Herbig Haro objects.
2. The top-20 well-defined SNDM paradoxes and design issues. Treating them as 'symptoms of flawed human thinking', allows for the application of multi-level Root Cause Analyses (RCA / FMEA) to uncover each underlying flawed human assumption, resulting in 20 very clear markers to navigate around when redesigning.

The final result is a synthesized process, paradox-free **by design** and thus far more likely correct than any other theory. The extended summary below condenses this SSF model, starting with a key flaw in our consensus theories involving proto stars:

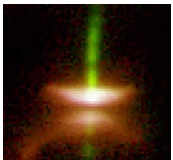
## -Extended Summary-

### Proto stars

'Halfway' through its contraction process towards fusion, a proto star can no longer accrete new mass due to its high angular momentum. As a result, the star's equator flattens into an elongated disk shape, storing excess in-falling mass and momentum. At this stage, unlike consensus thinking, the problem of a proto star is **not** a supposed lack of mass. The problem is that its acquired mass can not exert enough **pressure** on the core due to three blockers:

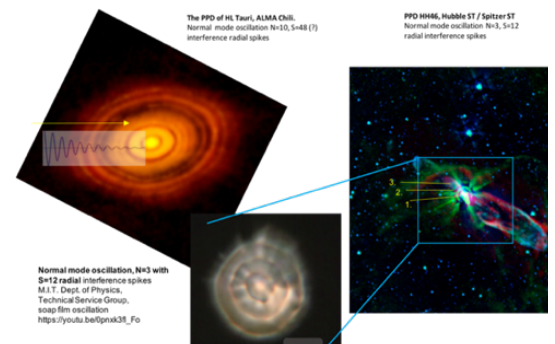
1. Too high angular momentum, counteracting the gravitational force the hydrogen exerts on the core
2. Too high *average* temperature, resulting in low density gas
3. A too large core, limiting the pressure the hydrogen can exert on the helium layer surface.

To further increase pressure, the star now 'changes tactics': In stead of accreting mass, it must now seek to **purge** momentum, heat and -above all- *core mass*. As with any high angular momentum disk shaped object -from tornado to galaxy- such purging typically happens via perpendicular jets. Unlike consensus believe this is **also** the case with proto stars: It is the growing momentum of the disk that jumpstarts a *series* of cyclical recurring proto stellar jets until the goal of reaching fusion conditions is achieved. In more detail:



The growing and ever faster spinning disk flattens the proto star to the extreme like a rubber band, until the star *inevitably* 'gives up' and *purges* its equatorial mass in a widening ring outward. The central proto star, having lost considerable equatorial momentum, will now elastically coil back and **reflate** to its former, more voluminous sphere shape. This 'instant' reflation induces **incoming** bi-polar vortices of cool disk halo gas (*Hubble ST HH30, left*). This bi-polar influx: 1. cools the star 2. brakes its rotation 3. **pushes out** hot hydrogen, momentum and core material through the eye of the vortices, forming the bipolar exhaust jets. This is how the star alleviates all three blockers!

Once they have slowed down the star's rotation, the short-lived (10k-100k years) vortices and jets will dwindle and vanish. Next, the star begins accreting mass anew, picking up rotation, flattening its interior until the next equatorial purge happens, starting a new 'jets-on' period. After each cycle the proto star will be smaller and denser, **leaving behind a set of concentric purge remnants in the accretion disk**, reflecting its shrinking size over time. **This** is what's behind the concentric wave pattern in the PPD of HL tau (ALMA, *right*) and HH46 (Spitzer, *far right*). As such, the open spacings are *unrelated* to planetary formation. Provided there is enough fuel in the form of in-falling molecular cloud gas, this cyclical process will automatically repeat until fusion conditions are reached. In short: proto star formation is not about linear mass contraction but all about cyclical mass purging! Given its tremendous importance, the entire process is schematically displayed on the next page.



### Gaseous planets

Parts of the ring shaped high-momentum equatorial purges may condense and combine to form high momentum gaseous planets like Saturn and Jupiter. Since these thus form out of purged *solar* material, the angular momentum paradox is solved. Indeed, recent observations of the disk of HL Tau hint at embryonic gaseous accumulations inside the *dense rings* of purged stellar mass, **not** inside their *open spacings* as long assumed by the scientific community. The more metals at the star's core, the more purges are needed, the more gaseous planets may be expected.

## Terrestrial planets

The gaseous planets like Jupiter and Saturn are explained, yet all other features in our solar system lack a solid link to the equatorial purges or even SNDM's 'proto planetary disk' (PPD): Neither the abundance of silicate debris inside the PPD nor its hypothesised condensing into fast spinning terrestrial spheres can be explained without assuming unobserved, unlinked, paradoxal processes, violating all three consistency criteria. However, unlike SNDM, our new process fundamentally includes the perpendicular mass outflows and these do offer a **1. connected 2. paradox free and 3. observed** sequence of events perfectly explaining the high-spin silicon oxide spheres:

At the base of proto staller jets, in-falling non-hydrogen gas, dust and silicate debris are observed to get sucked into the jets. Here the jet's phenomenal heat (8.000-12.000K) melts it into magmatic material, which is catapulted upwards in spirals during the star's periodic H/He purges. This H/He engulfed material next spins into liquid 'knots' or 'Herbig Haro objects' (*Hubble ST HH 111, right, HH34 time laps*) forming the embryonic stages of all **terrestrial spheres**, planets and moons alike. Slowing down their spin, gravity will next reorganise the elements of these proto spheres into layers. Iron and nickel sink to the core, pushing the lightest elements -predominantly oxygen- outward. The oxygen reacts with the jet's abundant hot diatomic hydrogen to form water vapour. On the inside the oxygen layer will produce thermal-induced vertically circulating silicate melts forming zircons. Additionally, as observed at L1448-MM, the proto star itself may typically eject massive amounts of water and other volatiles into the jets ending up as outer layers on the spheres.

Next, since the jets' central beam consists of ionised hydrogen, it constitutes an **electric current**, invoking a powerful **magnetic field**. At the outer part of the jets (in the case of HH47 the entire jet), the central beam typically changes from collimated to helix shape, which generates a **bar-magnet** shaped magnetic field. This will by definition **push out** all magnetised material - including metal core terrestrial spheres- and curve their trajectory **straight back** towards the star (*Hubble ST HH24, HH30 time laps*). Lighter, non-magnetic material is purged too far out and cannot return, arguably forming the double donut (2 jets) shaped Oort cloud. Covered in a halo of hot hydrogen and orbiting the star's rotational axis, the ousted proto-spheres will cool down and freeze over, looking much like the still intact ice spheres of Europe, Enceladus and Ganymede. Eventually some will reach the outer regions of the former PPD. Due to their disk perpendicular momentum they will next migrate inwards towards the star, crossing the Kuiper belt and some even the asteroid belt. This explains their **self-inflicted** Late Heavy Bombardment. Many terrestrial spheres will be re-absorbed by the star or the large gaseous planets; some will collide or be captured as terrestrial moons, while the largest only get gravitational slingshots upon passing the gaseous planets, ending up as rogue planets, TNO's or as the inner planets near the Sun. This paper also discusses an alternative, lower scoring, non-jet related terrestrial planetary formation, where first primordial fusion blasts may purge hydrogen wrapped core metals into the outer PPD, forming sizable cores from which further accretion inside the PPD is possible.

*The purging hypothesis can next integrally explain all further details of our solar system such as the combined formation of the Kuiper belt, Uranus, Neptune and Pluto followed by Saturn's rings, asteroid belt, the combined Earth/Lunar origin and the Faint Young Sun paradox. Summarised: In contrast to our current paradoxal 2D in-situ, disk-only theories, the purging hypothesis offers a superior 3D paradigm solving all paradoxes while fully integrating stellar and planetary formation. One can literally not happen without the other...*



### Proto star cycle towards fusion

#### Stage 1. Acceleration of rotation ('jets-off' phase)

- Gravitational collapse of molecular cloud (Bok globule) feeds accretion disk and its momentum;
- Central star flattens and compresses

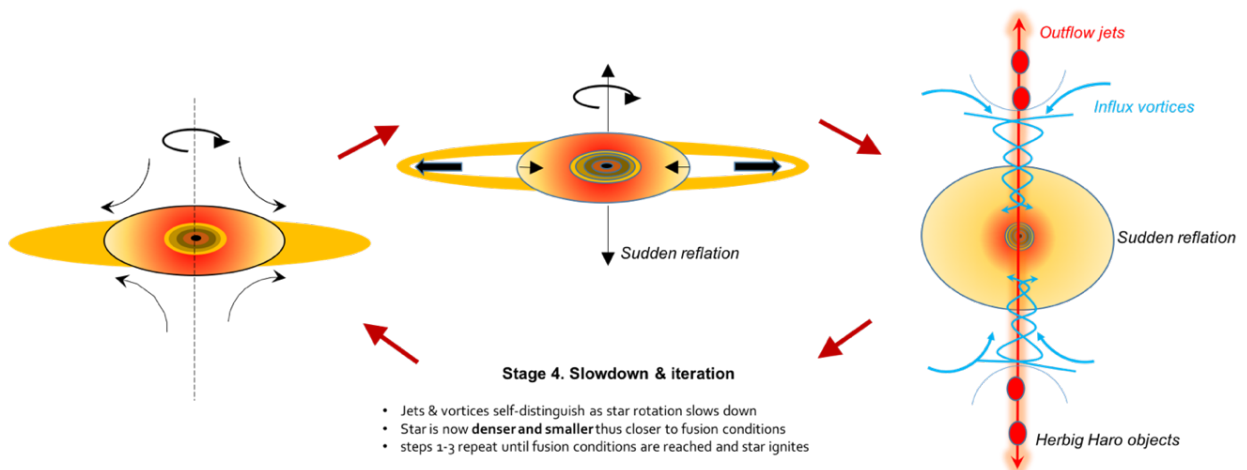
#### Stage 2. Equator detachment

- Momentum becomes too great at equator
- Equator detaches and slings outward
- Central star thus loses momentum and coils back to its former **more voluminous** sphere shape
- Sudden need for extra volume produces pressure low at poles inducing incoming polar flows

#### Stage 3. Braking of rotation

(short lived 'jets-on' phase, 10k-100k years)

- Star's instant need for more volume 'sucks in' new molecular gas
- The influx vortex brakes rotation, cools the star and pushes out momentum, heat and core material via central jets
- Vortices & jets sustain themselves absorbing the star's rotational momentum via the in- & outflow of gas. This constitutes a simple air brake mechanism



*The above cycle displays the elegant interplay between gravity and rotational gas dynamics, resulting in a binary purging of mass, alternating horizontally and vertically. The key principle is similar to a cyclone. Its greatest asset however is the extensive **observational** evidence from jets and PPD's (*Hubble ST, Spitzer ST, ALMA*).*

*In all; astronomers have confused the 'lack of pressure' problem for a 'lack of mass' problem, insisting linear mass contraction must somehow continue, even when the disk forms. This innocent looking misconception resulted in our paradox-laden consensus SSF theories. It also caused astronomers to ignore any process that fundamentally involves the **purging** of mass, even in the face of countless observations suggesting this is how Nature actually works.*

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## Annex 1. Jets and terrestrial spheres: A magnetic relation

# 1. Introduction and SNDM

## 1.1 The origin of the Nebular Hypothesis

The first part of solar system formation (SSF) is supposed to be well understood: Part of a molecular cloud contracts and collapses into an accretion disk with a proto-star at its centre. This was already broadly described in the 'Nebular hypothesis' published in 1755 by Immanuel Kant based on work of Swedenborg. LaPlace later published an improved model 1796. The hypothesis becomes less usable when trying to answer detailed questions like: How *exactly* do stars reach fusion conditions and how *exactly* do gaseous and terrestrial planets form? To explain such details, a modern version of the Nebular Hypothesis was introduced around 1970; The 'Solar Nebular Disk Model' SNDM credited to Victor Safranov. Though seen as an improvement, it is not without problems: There is the unexplained and unacceptable skewed distribution of angular momentum between the Sun and gaseous planets associated with this model. In addition, the suggested physics behind the formation of terrestrial planets is highly debated, nor is there a detailed process by which proto stars reach fusion conditions. Worse yet, recent observations of distant solar systems proved not consistent with SNDM, requiring ever more complex fixes. In all, this means one of two things:

Either solar system formation is an *extremely* complex process, or the 40 year-old SNDM theory is just fundamentally flawed. To investigate which of the two it is, a 2-year long research project was started to find an alternative hypothesis that would solve not just one, but all of our current paradoxes. Before addressing the new paradigm, first a short oversight is provided of the biggest problems of SNDM. It is by no means meant to be complete, but the next six issues provide a stark reminder of just how weak the case for SNDM actually is.

## 1.2 Issues of SNDM

### 1. The process leading to solar fusion

A contracting proto-star faces inherent physical issues preventing it from reaching fusion conditions: SNDM offers no clear explanation how a star yet reaches fusion conditions, nor does it integrate proto-stellar jets and vortices.

### 2. The forming of terrestrial planets

The current scientific consensus is that inside an accretion disk or 'proto planetary disk' (PPD) small grains grow into rocks and collide into larger rocks and finally into entire terrestrial planets. Yet, it is highly debated whether physics would even allow for clustering of small grains into rocks ('the 1-meter problem'), certainly without an additional heat source present. Gaseous planets in contrast, could very well accumulate mass inside a PPD, but also this process is not well understood and we need to be cautious drawing quick conclusions from recent footage.

A good example why caution is needed is the recent famous picture of the PPD of the young star HL Tau by ALMA showing some 10 open and equal distanced circles. It was instantly heralded as 'evidence' for planetary accretion. However, the realisation later sank in that 10 similar planets being born at 10 identical distances is unlikely. Instead it will be argued this is not related to planetary formation at all; It is a concentric wave pattern of material from a series of proto stellar equatorial purges, as predicted by the purging hypothesis.

### 3. The Angular Momentum Paradox.

SNDM suggests that our planets formed '*in situ*' in the disk, independent of the Sun. If true, then our Sun and planets should contain angular momentum relative to their mass. However, our Sun holds 99,8% of all mass inside the solar system but only 1,75 % of all angular momentum. In contrast, our planets combined have 0,2% of all mass yet hold 98,25% of all momentum. This imbalance is so grotesque that it effectively constitutes a no-go theorem for SNDM. Nevertheless, astronomers did adopt SNDM in the early 70's and ever since hypothesized complex internal disk processes to account for the angular momentum issue. None however proved substantial enough to solve the problem. The paradox is easy solvable, just not under SNDM.

### 4. The forming of Earth and Moon

Next, Earth and Moon formed. Chemical data of retrieved Lunar rocks indicate Earth and Moon have similar isotopic signatures and would be created almost simultaneously out of related material. This provides another problem for SNDM which suggests all terrestrial spheres are separately formed out of rocks inside the PPD. Astronomers came up with an ugly and isolated solution; a hypothetical collision between a *solid* proto Earth and a *solid* hypothetical 'Theia' planet, which instantly liquefied and merged both planets after which on the backside the Lunar mass popped out, solidifying into our Moon. This somewhat gullible 'Theia theory' basically only looks good in computer generated animations. More recent ideas include a more general notion of 'shared magma oceans', yet they remain ad-hoc and simulated proposals only. The purging hypothesis offers an *observable* and connected solution.

### 5. *The forming of water on Earth*

As a next stage, scientific consensus for decades was that water came to Earth transported by swarms of hypothetical ice-comets. There might have been, but looking at the vast quantities of water on Earth it is just highly unlikely. And would they also have visited Ganymede with its 700 km (source NASA) thick water ice layer? Recent geologic zirconia findings and deuterium measurements disproved the idea and next prompted other ad-hoc theories from asteroids to dehydration of indigenous rocks. It is however unlikely such hypothetical processes would produce enough water, certainly in the case of our ice moons. In Earth's case there is the further complication of a close-by igniting Sun. In contrast, the purging hypothesis offers a sound and *observable* explanation for Earth's water.

### 6. *The Late Heavy Bombardment, LHB (4,1-3,8 Billion y.a.)*

Although recently somewhat disputed, the consensus thought is that between 4.1 and 3,8 billion years ago, all inner planets have undergone intense bombardment by large asteroids. The leading explanation is that Jupiter would have made an orbital side step causing gravitational slingshots to asteroids hurling them towards the inner planets. Again, notice that the *need* for this exotic Jovian explanation is caused by the implicit *assumption* that all inner planets are born 'in situ' inside the PPD and the asteroids thus had to be dislocated. Yet, this bombardment –if it happened- can just as well be explained by the inner planets themselves migrating outside-in crossing the orbits of the steadily orbiting asteroids. We will later argue this is exactly what happened.



Looking objectively at each of the consensus explanations above, the situation is bleak. SNDM cannot convincingly explain any major aspect of solar system formation. Worse yet, none of the proposed answers are logically connected, failing to produce a coherent end-to-end 'story line' which is the earmark of any valid paradigm. As a 'paradigm' it is a loose conjecture of rather questionable and alternating solutions to individual aspects of SSF.

### 1.3 The human factor behind the issues

Many more inconsistencies and recent surprises could be mentioned. In fact, they are so plentiful that we have grown accustomed to them, accepting them as 'given vagaries' of Nature which we may come to understand at a later time. This 'paradigm forgiving' posture is somewhat misplaced when reflecting on the following quote:

*'... We tend to think of paradoxes as inherent complexities of nature which we may solve at a time of our liking. However, nature has no paradoxes. Paradoxes are always and without exception symptoms of flawed human thinking...'*

In line with this quote, the sheer number of paradoxes, issues, observational inconsistencies and the lack of coherent solutions makes a compelling case for reconsidering 40 years of SNDM based theories entirely, even if intellectually or politically inconvenient.

Underlying our troubled scientific progress is a growing disconnect between our leapfrogging observational capabilities (Hubble ST, Spitzer ST, ALMA) and our sluggish pace or even blatant refusal to adjust our ancient theories that originate from an era when the latest observational material was not known or even dreamt of.

Front and centre of our ancient theories is the 'accretion disk' to which all key functionality is attributed: Stopping just short of claiming the disk produced our proto Sun in stead of the other way around (!!), the disk would provide mass to the star in a hitherto unknown linear way, while somehow taking away its momentum and next grow 'in situ' planets prompting the angular momentum paradox. Physically, this concept is 'horrible' and hypothetical internal disk processes were invented to counter the inherent paradoxes that come with this awkward 'disk only' vision.

Fast forward to today, the latest observations reveal it is not the disk, but rather the spectacular perpendicular proto stellar vortices and jets that form the young protostar. This would include the theorised 3D Oort cloud as the logical structure for non returning jet-debris. If we allow ourselves to at least consider that these impressive perpendicular phenomena have a transient but fundamental role to play in solar system formation, we can synthesise a '3D' paradigm which is paradox free and perfectly in line with physics and observations. This paper next lays out the case for this superior 3D model making it unequivocally clear that sticking to our current 'flat disk-only' solar system formation model is as good an idea as sticking to a flat Earth model...

## 2. The purging hypothesis and planetary formation

Given the great inconsistencies if not impossibilities of SNDM as mentioned in the previous chapter, a research program was started, aimed at seeking an alternative, connective and paradox-free hypothesis.

### 2.1 Research Approach; Paradox Based Reversed Engineering (PBRE)

Taking the stance that our current SSF paradigm is flawed, leads to limitations on what material and method to use:

#### *Step 1: Ignoring existing studies*

Since the research premise is that the 40-year old SNDM is fundamentally flawed, there is an inherent problem with all research papers written since its introduction. The scientific tradition to a large extent requires any new research and researcher to refer to and expand upon earlier peer-reviewed work, ensuring base assumptions -in this case SNDM - permeate through all accepted research work. We thus had to ignore such research on principal grounds.

#### *Step 2: Ignoring the dysfunctional scientific method*

The scientific cycle of hypothesis, data collection, analysis and verification only works when incrementally 'forward designing', largely assuming correctness of earlier work. However, it becomes dysfunctional if we are to *challenge* all earlier work and need to come with an entirely new vision. One cannot develop such a complex end-to-end new concept with this method. It requires a reversed engineering approach based upon observation, creativity and logic.

#### *Step 3: Allowing only rough-cut observational data.*

Our main input source will be the latest footage of Hubble ST, Spitzer ST and ALMA. Interpretations of the community may be correct yet are not allowed as valid input data. Likewise, we will not accept computer generated simulations since unlike actual observations, these can inherently be tweaked to produce any desired outcome.

#### *Step 4: Introducing PBRE (Paradox Based Reversed Engineering) as the main method*

Since we do not know for sure which main aspects of our current SSF paradigm are **correct**, there is no starting point there. However, using the new method of 'Paradox Based connected Reversed Engineering (PBRE) we *can* derive with reasonable certainty which aspects of our current SSF paradigm must be **incorrect**. Navigating around these human errors, provides a novel but solid base for designing the new paradigm, this time free from human error and based upon the latest observations. As such, PBRE is specifically designed to turn our biggest problems into our greatest assets. We can summarise the 'dogmatic' PBRE approach as follows:

1. Nature has NO paradoxes. It is working just fine
2. Paradoxes are virtual contradictions caused by flawed human thinking only. Consequently:
3. Paradoxes can not be solved by looking for a 'hidden solution' in nature
4. Paradoxes can only be 'voided' or 'nullified' by systematically identifying and correcting the underlying flawed human assumptions, e.g. using PBRE. In more detail:
5. The method of PBRE puts emphasis on structured logic and creativity. It has the following steps:
  - a) Targeted voiding of each individual paradox by identifying their PFA (Paradigm Falsifying Argument)
  - b) Correcting the PFA via a 'best fit' PFAAH (Paradigm Falsifying Argument Alternative Hypothesis)
  - c) Scoring each PFAAH; The 'best fit' PFAAH is the option that scores best on the three consistency criteria:
    - It should be **logically linked** to solutions of the other PFA's
    - It should not invoke a physical / chemical paradox
    - It should be linked to an actual observation

Again: computer simulations or animations are NOT considered as support

After analysing and voiding all of the ca. 20 main paradoxes this way, one gets a chain of logically connected, paradox free and observation based PFAAH's, likely constituting the correct SSF paradigm.

### 2.2 Example of PBRE: The faint young Sun paradox

The inner workings of PBRE may require some elaboration and illustration: As an example we will take the 'faint young Sun paradox': Like all paradoxes it is formulated as a logic operator: If 'x' then why 'y'?

*'...If our Sun's output was only at 70% during early Hadean ('x')...,  
.....then how could Earth sustain liquid water ('y')...?'*

Over the past 50 years since Carl Sagan coined the 'faint young Sun paradox', we have tried to solve 'y' countless times, mostly suggesting super-greenhouse effects or internal radiation. At some point however our relentless but fruitless efforts start to resemble Einstein's witty definition of insanity: '...Doing the same thing over and over again and expecting a different result...' Ergo, at some point we must tackle the paradox differently: If we cannot solve the paradox by answering 'y' than something must be wrong with 'x' in stead. This is a *non-intuitive step*, since 'x' and 'y' above are both correct. Yet, there is a *hidden human assumption* in 'x' above, namely that our Sun would play a role in sustaining liquid water in the first place! From a logical standpoint, attacking this implicit assumption is the *best way* to eradicate this paradox. Thus, we come to the following 'Paradox Falsifying Argument (PFA)':

**'...The energy to sustain liquid water on Earth did NOT come from our faint young Sun...'**

Given our shared education, this feels like going against an 'incontrovertible truth'. However, our ice moons of Europe, Enceladus and Ganymede all have vast primordial oceans under their water ice layers and the 'faint Sun' for sure plays **no role at all** here. Admittedly, in the case of these ice moons, it is the gravitational influence of a close-by giant planet that generates the needed heat convection to melt and sustain liquid water above the rocky core. But this is not a pre-requisite: Similar heat convection can also be the result of rotational imbalance, e.g. in case of a damaged outer ice layer following a collision. We thus arrive at an alternative hypothesis (FPAAH): A Hadean Earth migrating inward, carrying a liquid ocean underneath its ice layer. Before dismissing it, let's objectively compare the facts:

*Earth forming 'in situ' near our Sun:*

1. is never observed.
2. is highly debated whether even physically possible
3. involves a Sun too weak to support its liquid surface water invoking a paradox
4. lacks a decent explanation of how water could have gotten there in the first place
5. has no logic connections to other aspects of solar system formation

*The alternative ice covered inward migrating Hadean Earth FPAAH:*

1. Solves the 'faint young Sun paradox' (!!)
2. Has **observational** support from our three ice moons and **all** 7 TRAPPIST-1 terrestrial planets all of which suspected of having a formidable outer water (ice) layer and to be migrating inward (Unterborn e.a., Nature 2018)
3. Provides excellent logic connectivity to other solutions e.g. terrestrial planet formation, jet based water formation, Earth-Moon isotopic similarities, Oort cloud and Late Heavy Bombardment as we will show later.

- *Driving out human opinion.* One should notice that the paradox typically contained an implicit opinionated human assumption, yet the resulting PFA typically does **NOT**. The PFA is the *logic consequence* of not finding a solution to 'y'. Precisely our extensive failures to solve 'y' increase the likelihood that the PFA is correct. This distinction is important as it drives out human opinion, which is what makes the PFA such a powerful instrument

- *Connectivity.* Since our main complaint regarding consensus ideas on SSF is 'ad hoc' fantasy and lack of connections, we were very rigorous about our design requirement of connectivity. Like a jig-saw puzzle, each individual solution had to logically connect to a solution of a different event (PFA) preceding or following it, *forcing* a coherent 'story line' that SNDM so desperately lacks. We assumed and were arguable proven correct that an (observed) solution that offers the best connections to others solutions, also offers the best explanation for the individual issue at hand.

- *Core solutions.* The next paragraphs contain the best fit solutions to three core issues: The angular momentum paradox, the water issue and terrestrial planetary formation. Next, the solutions to all the other issues suddenly all fall in place, with self evident logic and supported by the fantastic footage of Hubble, Spitzer and ALMA.

### 2.3 Solving the angular momentum paradox

The 'angular momentum paradox' is generally recognised as the most severe paradox of all. Although there is no universal law on how much skew is allowed between mass and angular momentum within a solar system, it seems impossible for a disk to form on the one hand our Sun with 99,8% of all mass, holding 1,7% of all angular momentum and on the other hand our planets with 0,2% of all mass and 98,3% of all momentum. Obviously, the simplest FPAAH solution to the paradox is that the disk did **not** produce the star, but rather the star produced the high momentum accretion disk during or after its own accretion. Thus, we have to redefine all planets as 'former solar mass'. By definition, this makes all current mass in our solar system 'solar mass' and all momentum 'solar momentum', solving the Paradox. Thus, until proven incorrect, our first premise becomes: **(1)'..our proto-Sun transfers angular momentum onto purged solar mass, some of which eventually accreted into our current planets..'** In theory, the paradox could also be solved if planets were deep space objects captured by our Sun. But this is unlikely since all planets orbit in the same direction. Moreover, the planets would still need to be created elsewhere.



## 2.4 Solving the water issue

Since large scale comet/asteroid water-import is not realistic, the focus has to be on mechanisms and conditions allowing for large scale *indigenous* forming of water on Earth. More over, there is no reason to suggest it is restricted to Earth, since the moons of Enceladus, Europe and Ganymede all have formidable layers of –frozen- water of up to 700 km. The best fit reversed engineering solution for such large-scale water production of up to 20% of radius is mass *chemical* production of water via the simple reaction  $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$ . For this there are two options:

1. Either proto-Earth would be in an environment deposits water on Earth, and/or:
2. Proto Earth itself would have a formidable outer layer of unbound oxygen, while being in an environment of hot diatomic hydrogen

Ad 1. The first option may seem unlikely, yet there is the case of L1448-MM (*Herschel ST*) where the protostar is observed to inject massive amounts of water into its jets (arguably the result of purging oxygen from its interior). It is speculated that this may be a –short- phase any proto star would go through. In order to receive the water, proto Earth would need to have formed inside a similar jet. In addition, Spitzer ST has also observed clouds of unbound elements and simple carbon oxides near the jets of HH46, in addition to clouds of water on other occasions.

Ad 2. With respect to the second option; An outer Earth layer of oxygen could be the final result of superheating dust and silicate debris breaking it down to their individual elements, yet it would require a phenomenal heat source. Again this points to proto-stellar jets. Here, in-falling dust and debris is **observed** to get superheated at 8.000-12.000K, after which it is catapulted upwards during periodic H/He purges. The additional requirement of a hot hydrogen-rich environment again points at the diatomic hydrogen filled jets. In all, from a water perspective, a jet-based origin for Earth is simply the best fit. It also avoids the complication of having an 'in situ' formation close-by the igniting Sun blowing away Earth's volatiles. Thus, until proven incorrect our second premise becomes;

**(2) '...all terrestrial spheres are born as magmatic spheres inside proto-stellar jets out of molten space debris...'**

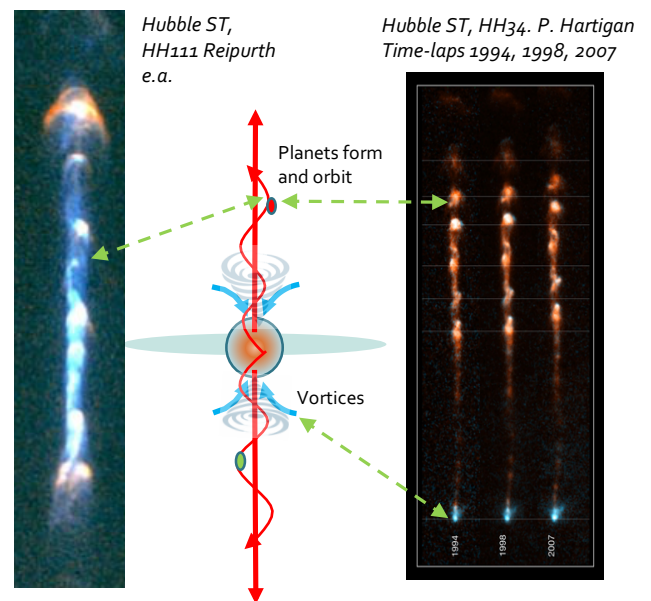
In contrast, the big gaseous planets lack the water argument and are far too massive to have formed inside jets. Given this quite radical break from SNDM, is there observable evidence for terrestrial spheres forming inside jets?

## 2.5 Solving terrestrial planetary formation

Remarkably, Hubble ST has indeed recorded the above *predicted* formation process on *many* occasions inside the hot hydrogen jets of proto stars. Such luminescent jet structures are referred to as a 'Herbig Haro' (HH) objects. In a Hubble time-laps movie study of HH 34 (*right*) one can clearly see 'knots' forming and starting to orbit the rotational axis of a proto Star! In the top right of HH34, even a binary appears to form. Earth and Moon may have formed similarly out of identical material. <https://youtu.be/ufadgneScAM>.

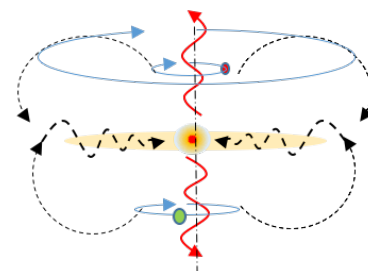
The total mass inside jets is limited, but the mechanics of the jets are such that the heaviest material is constantly pushed aside by the faster moving central beam of ionised hydrogen. The formation of proto Earth would then unfold as follows; As observed, the magmatic material spins into a sphere. Next, decreasing its spin, gravity reorganises its elements into structured layers: Heavy elements like iron and nickel sink to proto Earth's core, while oxygen and other lighter elements are pushed to its outer layers, reacting with the jet's abundant hot diatomic hydrogen to form large amounts of *water* (vapour). Minor quantities of nitrogen and carbon add ammonia, methane and carbon oxides. On the inside, the oxygen layer would produce thermal-induced vertically circulating silicate melts forming zircons. Additionally, as observed at L1448-MM, the proto star itself may typically eject massive amounts of water and other volatiles into the jets ending up as outer layers on the spheres.

At the outer end of the jets, the central beam of ionised hydrogen –constituting an electric current- can typically be seen to change from linear to helix shape. This will **change the jet's magnetic field into a bar magnet shape**, which by definition will oust all magnetic spheres while curving their trajectory straight back towards the star as **observed** in Hubble HH24 and HH30 (see Annex 1). Covered in a halo of hot hydrogen, proto-Earth would now orbit at a wider radius, falling back. It will cool down, solidify and freeze over outside-in, becoming a fast spinning silicon oxide sphere with a giant outer layer of predominantly water ice, looking quite similar to the current -still intact- ice moons of Enceladus, Europe and Ganymede. Although this distant and dynamic terrestrial planet formation may be emotionally hard to accept, in engineering terms it is *far* more *connective* and thus likely than the *never observed* and *highly controversial* 'in-situ' formation inside an accretion disk. The next paragraphs further demonstrate this superb forward connectivity:



## 2.6 Solving the Oort cloud and the Late Heavy Bombardment

The return trajectory of magnetised spheres from the jets would logically be an elliptical trajectory, perpendicular to their orbits around the rotational axis. Upon finally arriving at the outer PPD at ca. 4.1. billion y.a, the spheres would overshoot the PPD due to their perpendicular momentum and migrate outside-in with oscillating orbits, back towards the star. Such a motion is consistent with the recent observations of the seven terrestrial planets of TRAPPIST-1, all of which suspected of having substantial water (ice) layers while migrating inward! In Earth's case, the central orbital plane is clearly defined by the inline gravity of the Sun, Jupiter and Saturn. In all, we thus get the schematic fall back trajectory to the right. From this we can deduce several new predictions to expand and test the purging hypothesis:



### - The Oort cloud.

Since the gravitational and magnetic influence of a proto star is not endless, debris that leaves the jets too late, will not be able to fall back to the PPD anymore. In stead, it would orbit or hover at stationary distances. Thus the purging hypothesis predicts the presence of a distant cloud of hovering debris just beyond the borders of the trajectories as depicted above. Its inner border would be shaped like a double donut (2 jets) and the space between the inner border of this cloud and the PPD would logically be empty. Is there such a predicted cloud?

**Confirmation** → General consensus is that the Oort cloud indeed has the shape and size as predicted (*picture right, source Science News*). We now have a coherent and connected explanation where it came from and why it is shaped like it arguably is.



### - The Late Heavy Bombardment.

As depicted above, the purging hypothesis predicts that all terrestrial inner planets at some point migrate through the remnants of the PPD. As such they must all undergo a sudden but finite period of *self-inflicted* intense bombardment by debris, e.g. crossing the Kuiper belt and the asteroid belt.

**Confirmation**→ It is generally accepted that indeed Earth, Moon and all inner planets faced a period of 'Late Heavy Bombardment' at 4.1.-3.8 billion y.a. We now have a solid, simple and connected explanation of what caused it, without the need for a third external body (Jupiter) firing asteroids towards the inner planets.

## 2.7 Solving the Kuiper Belt, Neptune, Uranus, Pluto.

If the purging hypothesis is correct, Jupiter and Saturn were already established planets before the terrestrial planets returned to the PPD. If so, all terrestrial planets must pass Saturn and next Jupiter and run the risk of engulfment or being captured as their moons or slung into deep space. This gives us another prediction:

The only theoretic exception a terrestrial planet would not pass Saturn, is if two such terrestrial planets, e.g. coming from a northern and southern trajectory, would **collide** in the outer regions of the PPD. This could violently stop their momentum towards the Sun and Saturn.

**Confirmation**→ Until now astronomers were at a loss how Uranus and Neptune could form so quickly 'in situ' at the outer end of our the solar system and specifically how methane and ammonia could end up there. They might have been gaseous giants evolving like Jupiter and Saturn, but the purging hypothesis now offers a more logic alternative: Neptune and Uranus are early terrestrial planets, born inside the jets, explaining the presence of water, methane and ammonia. Later, *in solid condition*, they **collided** just beyond Neptune's current orbit resulting in 1) the Kuiper belt 2) ice comets 3) Uranus tilted axis 4) the loss of moons –Pluto- and 5) large-scale sublimation of their ices enabling fast accumulation of the PPD's residue hydrogen en helium, expanding Neptune and Uranus into their current sizes.

-Notice this chapter has already explained over a dozen of issues / paradoxes with just 1 single connected process (!)-

## 2.8 Solving the terrestrial moons of Saturn and Jupiter, Saturn's rings

If the purging hypothesis is correct, all terrestrial planets will migrate through the PPD as the in-line gravity of Saturn, Jupiter and the Sun forces them into trajectories that cross the orbits of the big gaseous giants. Being the first gaseous giant on their path, the purging hypothesis predicts that predominantly **Saturn, not Jupiter**, would be the scene for a 'cosmic pinball game with terrestrial planets'. Many small ice covered terrestrial spheres would be engulfed or captured as moons here, perhaps later colliding with new incoming terrestrial spheres. Heavier spheres would be hurled outwards becoming Trans Neptunian Objects or inwards becoming 'inner' planets or getting re-absorbed by the Sun. Additionally, some incoming terrestrial planets may already have a moon and collide with it at low speed during the gravitational slingshot of Saturn. In such cases, the smaller moon could be severely damaged e.g. losing its ice envelope. In all, by logic extension precisely Saturn should show remnants of many and massive ice-sphere collisions.

**Confirmation**→ Saturn and *only* Saturn has a massive ring system of 99,8% pure water ice and minor quantities of *regolith* (!!), highly consistent with this prediction. If they ever had outer ice envelopes, our Moon and Mercury are clear candidates for having lost it exactly here. Our human 'in situ' thinking emotionally objects to this, but physically and logically there is nothing 'outlandish' at all about this explanation.

## 2.9 Solving the 'faint young Sun paradox' and the Lunar Aitkin basin paradox

The realisation that inner terrestrial planets would have migrated inward passing Saturn and later Jupiter logically implies that the resulting gravitational slingshots could have them collide with their moon(s) at low speed and shallow angle. Again this may again sound 'outrageous' given our human 'in-situ' biased educational background, yet the cold logic reality is that it opens the door to solving also remaining paradoxes and issues:

### *The Aitkin basin paradox*

Our Moon has a mysterious impact basin called 'Aitkin Basin', forged at 4.1 Ga and generally believed to be the result of a giant collision with an unspecified wide body. Although it was its greatest ever impact, it left no obvious visual damage while each and every minor impact afterwards did visually damage its surface (a minor paradox). Naturally, with our Moon and our Earth colliding while covered in substantial ice layers, we now get a perfect explanation as to where the brunt of the impact energy would have gone into, allowing the Lunar surface to remain visually untouched. It perfectly explains why –and where! - our Moon would instantly have lost its entire ice envelope and some of its regolith. In addition, we get an answer as to why our Moon was next exposed and heavily scarred by the late heavy bombardment 4.1 Ga onward, while Earth was not, enjoying the protection of its damaged but still present ice layer. But there is a third, even more fantastic solution: the faint young Sun paradox can now be explained:

### *The faint young Sun paradox*

Planet-moon collisions may be violent and destructive but they are also **necessary** to make ice covered planets 'habitable'; A planet-moon collision would severely damage Earth's ice layer leading to rotational imbalance. The imbalance would logically lead to conversion of spin energy into surface heat convection allowing Earth's ice layer to melt inside-out in three steps:

1. First melts would create warm dark UV-free caveats in the ices just above the surface, where ammonia, methane, carbon oxide, hydrogen and water vapour could now form first amino acids (again a solution to a key issue!)
2. Increased ice melting would expose ever more of the Hadean surface, forming large rivers and sediments.
3. Finally, with its base shrinking, the entire ice layer would become unstable, grinding and pulverising the dark warm rocky Hadean surface before rendering it into the highly pressurized bottom of a deep all-encompassing Archean ocean. Of course this would also explain the 'faint young Sun paradox' and our missing Hadean rocks.



*The ice moons of Enceladus, Europa and Ganymede (with its record 700 km thick water/ice layer, NASA)*

The purging hypothesis suggests these spheres represent the archetype for ALL larger sized terrestrial spheres at their birth. This includes Earth, Mars, Venus, Mercury and our own moon. Our moon would have lost its ice shell at a first collision near Saturn approx. 4.1 Billion y.a. as its Aitkin basin region allegedly hit Earth at its current Arctic region (the inversed Clementine alto / pressure maps highly correlate). If correct, some sections of Saturn's outer rings may still contain Lunar ice and regolith. Moving on, the Lunar surface would be exposed to 'Late Heavy Bombardment' impacts while Earth for long kept its protective but melting ice layer. Both spheres gradually moved their collision area's – Aitkin Basin and the Arctic- to a rotational pole as to minimize rotational imbalance.

The realisation that inner planets could have collided with their moons, spawned an additional year long research of maps on geology, vertical crust motion and gravitational anomalies. A separate document was dedicated to it and the results are breath-taking.

## **2.9 Solving gaseous planets**

After describing the formation of terrestrial planets in detail, the focus shifts to the gaseous planets. The purging hypothesis predicts they formed out of purged solar mass and earlier we reasoned they are too massive to have formed inside proto stellar jets, leaving only equatorial purges as an option. Our third premise thus becomes: **(3)'..Gaseous planets accrete out of the remnants of proto stellar equatorial purges (forming the accretion disk).'** In the next chapter we will show there is overwhelming support for this. Unexpectedly, it provides new insights into the accretion disk and its relation to jets and star birth.

## 3. The purging hypothesis and proto star formation

### 3.1 The current explanation of the process towards fusion

Looking at literature, the process of a proto star reaching fusion is often described as a runaway process where mass simply contracts until fusion conditions are reached, although at times there is the more sophisticated notion that linear contraction at some point becomes impossible due to too high angular momentum:

*Wikipedia: '...The gas that collapses toward the centre of the dense core first builds up a low-mass proto star, and then a proto-planetary disk orbiting the object. As the collapse continues, an increasing amount of gas impacts the disk rather than the star, a consequence of angular momentum conservation. Exactly how material in the disk spirals inward onto the proto star is not yet understood, despite a great deal of theoretical effort. This problem is illustrative of the larger issue of accretion disk theory, which plays a role in much of astrophysics. Regardless of the details...' etc., etc.*



The above description is a fair approximation of the general scientific consensus of this crucial stage in the life of a proto star. Remarkably, even after 300 years, the process is really only known with certainty up to the point where the proto star can no longer take on more mass because of its growing angular momentum (spin) and starts to grow an 'accretion disk' or rather 'flywheel', storing excess mass and angular momentum. This is a physically sound process and has been observed countless times. But...now look carefully at the underlined follow-up process Wikipedia suggests above. With a very subtle choice of words Wikipedia suggests we would know *for sure* that mass next simply reverses from the disk onto the proto star (...!), adding that this process is just 'not yet understood' (...!) after which it concludes it is a mere 'detail' anyway (...!). Fact is we don't know this to be true at all. We *do* know however that *if* it were true,

1. it would be a most remarkable 'linear' process seemingly defying logic and Newtonian physics.
2. it gives rise to the angular momentum paradox
3. it cannot not explain the occurrence of vortices and jets, which by now *we know* play an important role.

The reason why mainstream science proposes this awkward process, is because they erroneously believe proto star formation is all about accreting as much mass as possible, just like a singularity. That is nonsense; Gathering mass is just a means, not an end. The physical goal of the star is to **increase pressure, not acquiring more mass per se**. The moment the accretion disk forms, marks the infliction point where taking on more mass no longer 'works'. But nature is more sophisticated than we think: It now uses the growing amount of momentum stored in the accretion disk as a 'flywheel' to initiate another process aimed at further increasing the pressure at its core. To understand this, we need to spend a bit more time on the actual problem:

### 3.2 The proto star problem: A lack of pressure, not mass

At this important stage, the main problem a proto star faces is **NOT** a lack of mass as suggested by SNDM; The problem is that the already accreted mass cannot perform its function of compressing the lowest hydrogen levels to fusion conditions. No amount of extra mass can solve this. There are *three* issues:

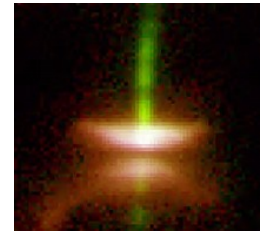
1. *Too high angular momentum.* Obviously, high angular momentum counteracts the gravitational force that the accumulated gas exerts on the surface of the core. As a result, the hydrogen pressure right above the core remains far from fusion levels. Any follow-up process should target this excess angular momentum.
2. *Too high average temperature.* The temperature just above the core must be high to reach fusion conditions. But in contrast, the average star temperature should be LOW. Cool gas is denser and allows for greater pressure on the core and a smaller core in itself. Though a lot of heat is generated and radiated outwards, it would help if the follow-up process would 'artificially' expedite this cooling process.
3. *Too big core size.* This is an overlooked issue. As the molecular cloud contracts, the heavier elements like helium spiral to the centre of the future proto star and logically *remain there* in ever more separated and compressed form. Obviously a large core is a **big** negative as achievable pressure is inversely related to the size of the helium surface the hydrogen mass rests upon. Any follow-up process should therefore 'artificially' hurl most helium away. As addressed later, bringing down the core size may very well be the single most important aspect.

In order to yet reach fusion conditions, the proto star must next **PURGE** momentum, heat and core material. Looking at disk-jet constellations at other scales (galaxies, whirlpools, tornados), nature by default purges momentum perpendicular to the disk itself. As such, the overwhelming number of observations of vortices and jets around young stars suggests that these perpendicular phenomena, although transitory, **fundamentally belong** to this purging process and we need to integrate them into SNDM even if SNDM itself would change beyond recognition.

### 3.3 The solution: Periodic vortices & jets

To complete the correct 3D process, we must

1. start at the moment the star gets flattened by the disk
2. end with a compressed star with fusion conditions.
3. fundamentally integrate the infamous and impressive proto stellar vortices and jets, observed at evolved stages of proto stellar formation (*HH 30 NASA/ESA right*).



#### Stage 1 en 2 : Acceleration and equatorial purge

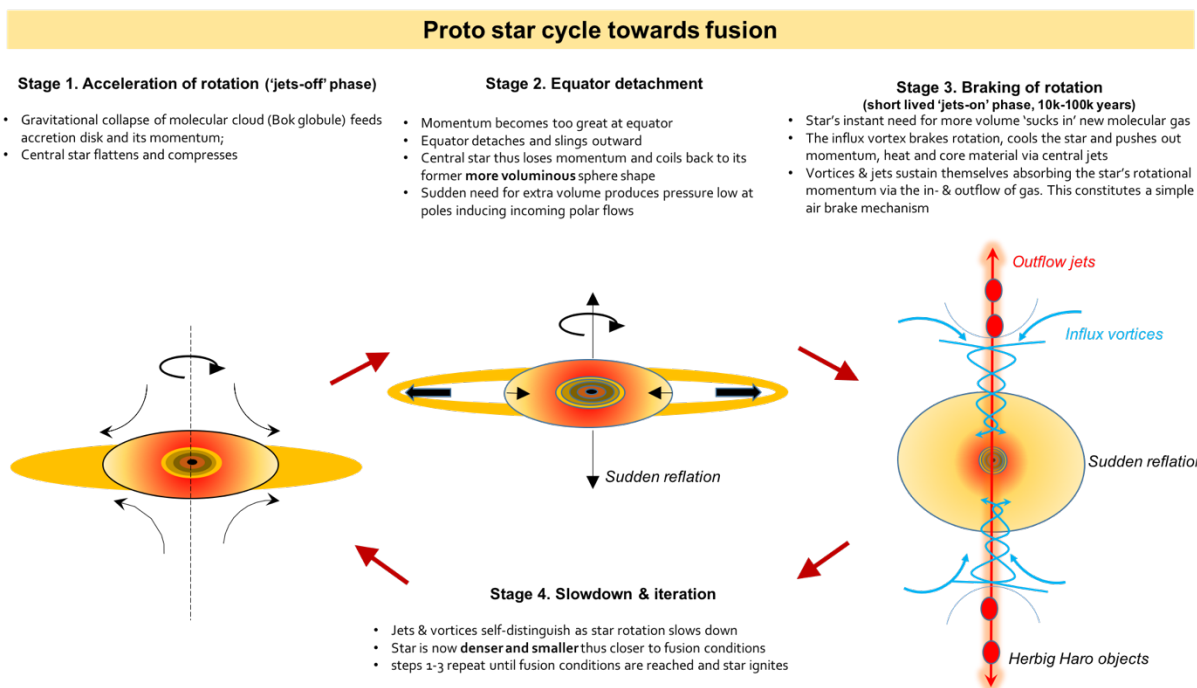
The ever increasing momentum and mass of the disk ('elongated equator') flattens the star to the extreme like a rubber band. Since there is **no logical stop** to this process, the outcome is inevitable: At some point the momentum of the disk becomes so great that it detaches from the central star, forming a ring shaped purge of equatorial mass moving outward due to centrifugal forces. Parts of this swirling ring may condense to form large gaseous planets (Saturn, Jupiter). Since these thus form out of ex-solar material the angular momentum paradox is solved.

#### Stage 3 Braking phase: forming of vortices and jets

Thanks to its equatorial purge the proto star has lost substantial momentum, allowing it to elastically coil back, 'reflating' towards its former, **more voluminous sphere shape**. This quick 'reflation' requires extra volume, causing a pressure low at the star's rotational poles, leading to a sustained influx of cold and dense gas from the molecular cloud forming vortices. This bi-polar influx: 1. brakes the rotation 2. cools the interior of the proto star 3. pushes out hot hydrogen, angular momentum and core mass back up through the eye of the vortices, forming the bipolar exhaust outflows or 'jets'. Notice that polar influx gas, passes the jet outflow it produces through its centre. Both flows are vertically opposed *and* rotate in the opposite direction. As such, a substantial part of the heavier components of the incoming molecular gas (He, Li, silicate dust and debris) will swirl and get 'sucked in' by the jet's base not entering the star at all. As a result, the H/He ratio of the polar influx is substantially higher than the jet-outflow which has a H/He ratio of 3:1. Therefore, each jet period improves the star's interior H/He ratio, bringing it closer to fusion conditions. Furthermore, it is important to realise the primary star reflation is only needed to 'jumpstart' the vortices and jets. Once initiated, the vortices and jets will sustain themselves by absorbing momentum from the star's rotation through the in/out flow of gas. De facto, they constitute an elegant 'air brake' mechanism.

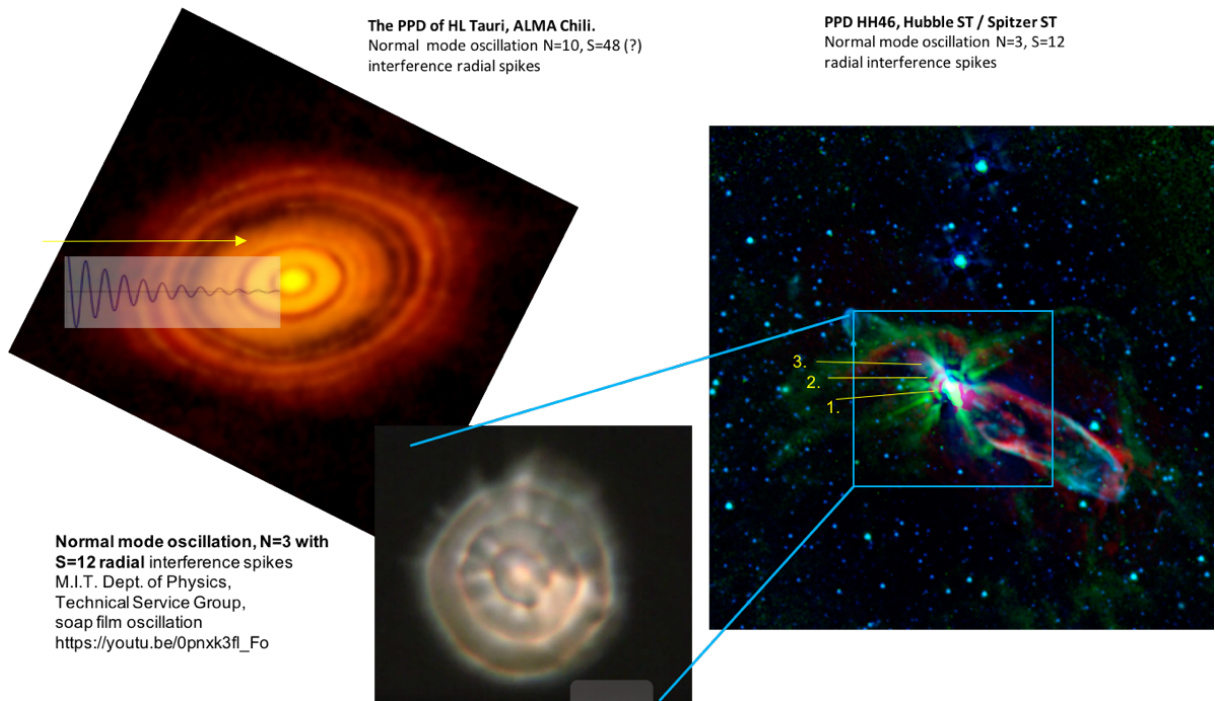
#### Stage 4. Iteration

Ultimately, the vortices and jets are self-distinguishing features; Once they have slowed down the star enough they will dwindle and disappear. Now, the cycle will repeat: The proto star starts accreting mass again from the molecular cloud, perhaps even reclaiming parts of the earlier purged equatorial mass. Its rotation increases, the star flattens and compresses until the next equatorial purge happens, starting a next 'jets on' period. Provided enough fuel in the form of collapsing molecular cloud gas is available, this repetitive process will ultimately lead to fusion conditions since after each cycle, the proto star is more condensed, has a better H/He ratio and a smaller core: The more helium and metals at the star's core, the more purges are needed and the more gaseous planets can be expected to form:



### 3.4 The disk wave patterns of HL Tau and HH46

The proto star cycle as described in the previous paragraph is an ingenious 'piston-like' compression process. It allows the star to periodically 'suck in' cool hydrogen, while purging hot core mass, compressing itself to fusion conditions. As such, the series of equatorial purges must logically leave behind a pattern of ever smaller concentric circles in accretion disks, reflecting the shrinking size of the proto star over time. This is where the famous picture of the accretion disk of HL TAU by ALMA (*below left*) comes in, showing precisely this predicted wave pattern of concentric equal spaced rings.



The near perfect *wave pattern* becomes apparent by the superimposed sinus wave below. The situation of e.g. HH46 also resembles a normal oscillation mode wave pattern.

Remarkably, the open rings phenomenon was initially heralded by mainstream astronomy as 'indisputable evidence' for 'SNDM planetary formation'. Yet as time passed, no confirming indications for planetary formation were found inside the open spacings. Also, realisation began to sink in that 10 identical planets forming at 10 identical distances is really not very likely. On top of this, new studies indicated several gaseous accumulations are forming inside the rings themselves, not inside their open spacings, again precisely as the purging hypothesis predicts.

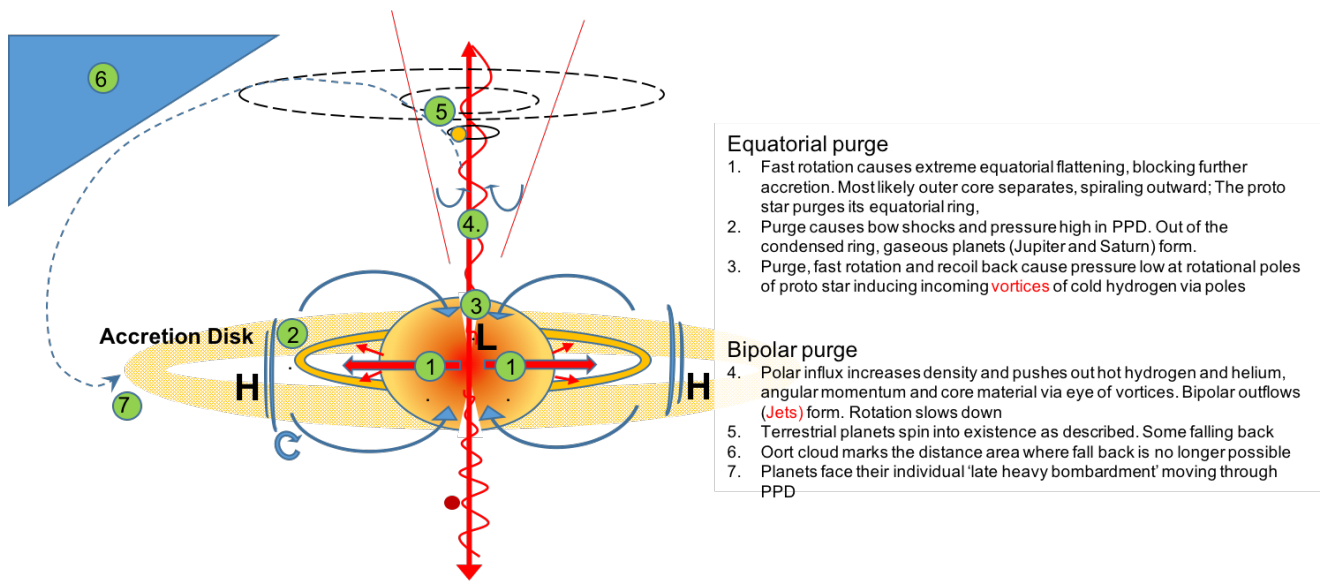
One might expect that this recent footage of the PPD of HL Tau or HH46 would lead astronomers to give up on SNDM and accept the obvious cyclical purging nature of proto stars. Yet to this day, mainstream astronomy remains committed to the ailing SNDM theory, trying to yet explain the open spacings as a function of planetary formation using computer animations. Such efforts merely reflect our inclination to deny human fallibility. As such, one may argue the 'scientific' value of such animations is limited to the field of human psychology only.

Overlooking all that is discussed and presented, we should acknowledge that the purging hypothesis:

1. (Unlike SNDM) Is rooted in solid Newtonian physics
2. (Unlike SNDM) Has solid supporting observational evidence in countless HH images and the above disk images
3. Solves the angular momentum paradox and all other open issues of solar system formation
4. (Unlike SNDM) Does not need any auxiliary hypothetical process, circumstance, object or simulation. All of its individual formation aspects are observable and functionally linked, with clear and self-evident logic.
5. Has no paradoxes of itself.
6. Fully integrates stellar birth with planetary formation in a solid end-to-end process.

As such, the superiority of the 3D purging hypothesis over the old 2D 'in situ, flat-disk-only' model is obvious and of historic proportions. At this point only academic inertia can postpone the overhaul of our 300-year old and ailing nebular hypothesis / SNDM.

Schematically, we can summarize the purging hypothesis as below



### 3.5 Herbig Haro knots, T-Tauri phase & alternative terrestrial planet formation

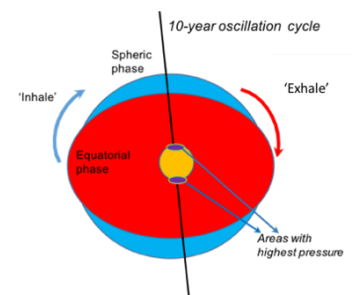
In this final paragraph we would like to speculate on the origin of Herbig Haro objects. Although little footage is available at these scales, Hubble ST recorded a fantastic detailed time laps video of HH34. Here one can witness the series of H/He purges seemingly coming from its interior:



There are various supporting arguments for this:

1. At nearly all HH objects, one can see the knots form *incrementally* producing a string of periodic purges. If the H/He purges were formed out of in-falling cloud material, one would expect to see a more continuous flow of material and a less strict frequency, if any.
2. The Hubble HH34 time laps study shows the base of the vortex is seriously disrupted anytime a knot is 'fired' outward from the star's surface. Exterior originating knots would not cause such an influx distortion.
3. There is a 'motive'. Core purges would not just shed momentum and heat, but also produce a *smaller core* which means greater pressure on the remaining core expediting fusion in a self-enforcing manner.

Referring to the observed frequency of HH34 above; the H/He 'knots' are fired into the jets with a frequency of some 10 years. The proto star itself is the only object around that could produce such a steady 10y frequency, e.g. by oscillating between a slightly more sphere-shape and an equatorial bulge-shape, much like a large soap bubble does (see right). Perhaps our 11-year Sun spot cycle may have its origin here as well. Notice this oscillation will not influence the jets themselves: Once initiated the jets will stay active for as long as the star has fast rotation regardless this minor 10-year oscillation.



Following up on the minor 10y cycle; during the 'inhale' phase of the oscillation the pressure would gradually mount as the star becomes slightly more sphere-shaped. This would pinch the central interior outflow duct somewhat, causing a 'clogging' of outward bound core material. This in turn would lead to a gradual accumulation of hot core material under both rotational poles bursting into space every 10 years or so. At the moment of its outward burst, the clogged material on its turn would temporarily disrupt the *influx* vortex of new material. This is exactly what we see at the second HH34 picture from the left above!



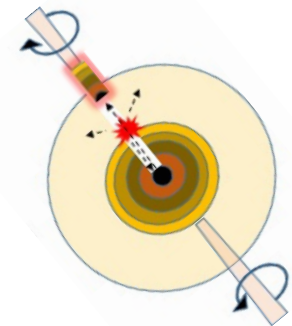
In addition: Since jets typically last 10k-100k years, and the minor oscillation has a frequency of some 10 years, there would typically be some 1000 to 10.000 minor oscillations during a 'jets-on' period, producing the same amount of 'puffs' or HH objects, each producing one or a limited cluster of proto-planets. As our current solar system roughly contains some 100 terrestrial spheres (planets, moons, TNO's, KBO's, asteroids like Vesta), this means less than 1% of all jet-produced spheres may typically make it as stable objects in our solar system. Over 99% would have been destroyed, engulfed or travel as interstellar rogue planets.

*First hydrogen blasts*

Although the proto star would predominantly simply 'push out' helium and other core material into the jets, in final stages it may very well be that first hydrogen fusion blasts would also come into play.

Although highly speculative, such first blasts might be able to purge cross-section core material either via a purge on the other side or after deflecting 180-degrees off the core as displayed to the right. The purges would logically consist of hot hydrogen wrapped He and Li with perhaps remnants of residual proto star layers of Fe, Ni, Si, C, N, O, S -if the star has these-.

The core would re-organise on a slightly smaller scale and thus with a slightly higher pressure on it. If indeed this happens, e.g. during the T-Tauri phase, then effectively jets would no longer be needed as the star would now have a self-enforcing new method of purging, exponentially slashing its core in a run away process at an ever increasing rate, expanding the area with fusion conditions towards the equator. The very moment the entire lower hydrogen layer exceeds the limit, a short outburst to upward layers would officially ignite the star, seeking hydrostatic equilibrium.



*Alternative terrestrial planetary formation*

By logic extension, these non-jet purges of hot hydrogen wrapped 'metallic' core material would follow more shallow trajectories, allowing them to quickly end up in the outer PPD and constitute decently-sized cores heavy enough to accrete additional rocky material –e.g. produced by the jets-. These could next grow into mature terrestrial planets over the millions of years that the PPD exists.

Compared to a jet-based origin, the 'PFAAH score' for this terrestrial planet formation option is lower since it scores slightly less on connectivity and observation (the observed gigantic XZ Tauri 'bubble' eruption may tentatively count). Nevertheless, it could be a viable alternative to the jet-based option and perhaps both even apply. Both options are products of stellar purging -needed to counter the angular momentum paradox- and this qualifies them ab initio.

Zooming out a bit, it is also worth noticing that the entire SSF process of the purging hypothesis would bring symmetry in the life of a star, making star birth the exact inverse of star death:

**Star Death**

Inflation in several steps  
*Creating* elements between helium and iron  
 Final expansion and next contraction towards death

**Star Birth**

Contraction in several steps  
*Purging* elements between helium and iron  
 Final contraction and next expansion towards birth

# Annex 1. Jets and terrestrial spheres: a magnetic relation

The jet's fast moving central beam of –partly- ionised hydrogen constitutes an electric current and as such invokes a powerful magnetic field. The beam would magnetize all condensing objects containing metals and would next dominate their further motion within the jets. Near the star itself, the beam is collimated or 'wire-like', producing a circular shaped magnetic field, forcing material to orbit and accelerate upwards.

As the beam stretches further out, it typically changes into a more helix shape. Crucially, this means that its magnetic field structure now morphs into a bar magnet shape. It is a physical law, not a theory, that this WILL push out all magnetised objects and next curve their trajectory back towards the star: Below this is illustrated at HH24 (Hubble ST):

**1. Straight line E-current**  
Magnetic field circles around axis

*Proto spheres magnetize and next spiral 'upward'*

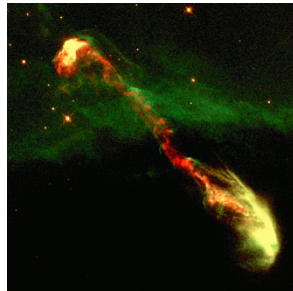
**2. Widening helix E-current;**  
Magnetic field reshapes as a bar magnet

*Proto spheres get pushed out & curved down back towards the PPD as observed in dust trail in HH24 enlargement*

**3. HH30 also displays the out & down effect at the upper half of its jet**

The Dynamic HH 30 Disk and Jet  
Hubble Space Telescope • WFPC2

NASA and A. Watson (Instituto de Astronomía, UNAM, Mexico) • STScI-PRC00-32b



In some instances (e.g. HH47 left) the entire jet is helix shaped. Quite likely this erratic structure represents the end of a 'jets-on' phase, where the jet is about to dwindle and vanish completely. In such cases the return trajectory for jet-produced terrestrial spheres could start almost immediately. Given the limited distance such spheres would need to travel, it is plausible that precisely the erratic phase will produce the terrestrial spheres that actually end up inside the solar system.