About Rockets in Space:

Landing on the moon was an important national project for many countries. I don't think that the responsible scientists were beginners, they were all experts who shouldn't fail. The failure is their first experiment in such an environment. If that environment was expectable to normal people like us then they wouldn't fail. The failures of USSR, USA and China were the experimental discovery of how rockets behave in such large vacuums, then, those countries started succeeding. The vacuum environment in space should be considered with an infinite size. However, we can use a very tiny rocket in a very large room where there is the cooled vacuum to observe how the thrust will be influenced, but without changing the vacuum characteristics by the rocket's combustion. An obvious exchange of gases between two environments happens, we should compare the rate of that exchange with the useful expansion velocity of those combustion gases in order to conclude if the combustion gases pressure is enough for the thrust. It is a pure thermodynamic issue about very fast molecular effusion.

In the vacuum, the thrown or expelled object is similar to an object that has become detached from a moving system. No force is exercised to get a reacting force, it is only detached. Imagine a rotating system suspended by a wire, then the wire is cut. Please do that experiment. No reaction force happens. Rockets in the vacuum keep there velocity by inertia, but there acceleration stays null which means that they encounter no forces at all.

I don't refuse Newton laws at all but that effusion is an additional force on the molecules which makes their expansion unable to thrust the rocket. It is different then the normal nineteenth century experiments that you can find on YouTube. The size of the vacuum and its latent energy should be considered infinite in the needed experiment. Please see also the following simplifying drawing:
In the nozzle, the fuel and oxygen molecules become in direct contact with the space infinite vacuum. Therefore, they have effusion forces acting upon them. Let's consider that the combustion happens and that the molecules have also expansion forces:

\[ \Sigma F_i \text{ of expansion forces} \]

**Simplified in-nozzle.**

\[ \vec{F}_i \text{: molecular expansion forces after ignition.} \]

\[ \vec{f}_i \text{: molecular effusion forces towards the vacuum.} \]

- Newton predicts a reaction forwards of the rocket but only if the molecules hit the in-nozzle walls with an impact force.
- The effusion molecular forces can become so strong that molecules won't hit the walls, since for each combustion gas molecule \( \vec{F}_i = m \vec{a} \) where \( \vec{a} \) is the acceleration of the molecules.