

# Group 25 - A First Look at Planet 9

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It is well known that there are currently eight planets in our Solar System. However, over the past decade, when observing the gravity perturbations and unusual orbit inclinations of several Kuiper Belt objects, astronomers are led to believe that they are caused by an unaccounted mass. Simulations indicate that this mass could be a ninth planet, more than six times the mass of Earth. The most precise current estimates place this potential planet at approximately 550 AU (8.2E10 km). For the purposes of this project, it is assumed that Planet 9 will be discovered within the next ten years and will be located at 550AU.

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## Mission Objective

The NIBIRU (Novel, Intelligent, Beyond Interplanetary Research Unit) mission aims to characterise the ninth planet in our Solar System. It will determine whether this planet is a Super-Earth or a mini-Neptune, providing valuable insights into planetary formation. Additionally, NIBIRU will study the planetary bodies it encounters along its trajectory, including those in the Kuiper Belt, the Heliosphere, and the interstellar medium.

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## System Design

The NIBIRU mission will consist of the NIBIRU spacecraft and two kick stages. The assembly will be launched on an interplanetary trajectory to Jupiter by a SpaceX Starship. A gravity assist from Jupiter, combined with a burn from the ENKI (Energetic NIBIRU Kick Interstage) kick stage, will direct NIBIRU towards a swing-by of the Sun. At this point, the ENLIL (Efficient NIBIRU Long-range Interstage Launcher) kick stage will provide the final necessary  $\Delta V$  to reach Planet 9 within 50 years.

During the gravity assist of Jupiter, the NIBIRU probe will perform measurements of the planet as part of the mission's secondary objectives, and at the same time verify the operations of its science instruments. Subsequent to the swing-by of the Sun, the probe will be on its own for the remainder of its journey. The next targets of opportunity which will be characterised are in the Kuiper Belt (30-50AU). After having passed the Kuiper Belt, NIBIRU will continue through the outer parts of the Heliosphere, in which it will perform in-situ environmental measurements. After characterising and passing the border of the Heliosphere (100 AU), NIBIRU will officially be in interstellar space. This area of space is mostly unexplored, therefore similar measurements will be conducted.

The NIBIRU probe was designed to meet stakeholders' requirements for characterising

Planet 9. The subsystems are engineered to enable the science instruments to effectively characterise the planet during a fly-by. The subsystems were designed concurrently to ensure that the design phase was as efficient as possible. All of the subsystems have undergone multiple trade-offs and iterations to achieve a design with the necessary performance and compliant to all requirements.

Once NIBIRU has arrived at its flyby radius from Planet 9, it will begin its primary objective: characterising the planet. This will be accomplished using the imager and spectrometer. Due to the limited power available after 50 years, NIBIRU will make use of the different operation modes to allow the spacecraft to send all of the science data over the vast distance that lies between the Earth and Planet 9.

