The Influence of Magnetic Fields on Atmospheric Escape From Exoplanets

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Exoplanets orbiting close to their host stars receive high-energy stellar radiation that causes their atmospheres to escape. Understanding atmospheric escape on exoplanets is important to understanding the general demographics of exoplanets and the physical and chemical properties of their atmospheres. Magnetic fields could interact with ions and affect their trajectory through the Lorentz force, potentially altering escape rates. This research modeled the atmospheric escape from the exoplanet HD209458b. Using a pre-established model for the upper atmosphere of HD209458b's atmosphere and a model of the planet's assumed magnetic dipole, the research calculated the magnetization parameter as a function of the distance from the exoplanet for the most common ions in the HD209458b's atmosphere. Hydrogen ions and electrons appeared more susceptible to being caught in a gyrating motion by the magnetic field due to their lower mass. Heavier helium ions would potentially be caught in the magnetic field at a much further distance from the planet due to lower collision frequencies. This investigation of the effect of a dipole magnetic field on the escaping ions in HD209458b's atmosphere shows that lighter ions may be captured by the magnetic field, potentially lowering escape rates around the equator and enhancing them at the poles. This could affect estimated escape rates and the distribution of ions in the atmosphere of HD209458b and similar planets.

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