



## Enrichment of the HR 8799 planets by minor bodies and dust

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Are minor bodies and dust delivering volatile and/or refractory materials in exoplanetary systems?

Around ~20% of the nearest stars are found to host analogues of the main asteroid belt and the Kuiper belt. Our aim is to study the possibility of material delivery through minor bodies and dust to the planetary surfaces. To shed light on these delivery processes we extrapolate our Solar System scenarios to the exoplanetary system HR 8799. The system is known to host four giant planets and two belts of minor bodies.

We performed a set of N-body simulations to study the impact rates of minor bodies and dust on the HR 8799 planets. We find that the planets suffer impacts by objects from the inner and outer belt. We convert these to volatile and refractory delivery rates using our best estimates of the total mass contained in the belts and their volatile/refractory content. Over their lifetime, the four giant planets receive between  $10^{-4}$  and  $10^{-3} M_{\text{Earth}}$  of material from both belts. This delivery leads to volatile and refractory enrichment of the planets that may be observable. Since the four giants HR 8799 e, d, c, b are located beyond the snow line (and presumably formed there), we expect them to be born volatile-rich. Therefore any future detection of refractories might imply delivery through impacts.