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# Jupiter's formation: heavy element enrichment and link to giant exoplanets

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## Abstract

We investigate Jupiter's growth focusing on the amount of heavy elements accreted by the planet, and its comparison with recent structure models. Our model assumes an initial core growth dominated by pebble accretion, and a second growth phase that is characterised by a moderate accretion of both planetesimals and gas. The third phase is dominated by runaway gas accretion where the planet is detached from the disk. In order for Jupiter to consist of 20-40 $M_\oplus$ of heavy elements as suggested by structure models, we find that Jupiter's formation location is preferably beyond the water iceline. We find that Jupiter could accrete up to 15 $M_\oplus$ of heavy elements during runaway gas accretion, yielding an envelope metallicity of 0.5 to 3 times solar. By computing the solid (heavy-element) accretion during the third phase, we infer a planetary mass-metallicity relation that we compare with previous works [1, 2]. Finally, we show that the high bulk metallicity inferred for many giant exoplanets is difficult to explain from standard formation models. This implies a migration history for such highly enriched giant exoplanets and/or giant impacts after the disk's dispersal.

## References

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