Contribution ID: 4   Type: **EMP stars**

Metal pollution of low-mass Population III stars through accretion of interstellar objects

Wednesday, 5 December 2018 12:30 (20 minutes)

We calculate accretion mass of interstellar objects (ISOs) like Oumuamua onto low-mass population III stars (Pop. III survivors), and estimate surface pollution of Pop. III survivors. An ISO number density estimated from the discovery ofOumuamua is so high (~ 0.2 au^{-3}) that Pop.~III survivors have chances at colliding with ISOs about 10^5 times per 1~Gyr. 'Oumuamua itself would be sublimated near Pop.~III survivors, since it has small size, ~ 100 m. However, ISOs with size ≥ 3 km would reach the Pop. III survivor surfaces. Supposing an ISO cumulative number density with size larger than D is $n \propto D^{-\alpha}$, Pop. III survivors can accrete ISO mass $\geq 10^{-16}M_\odot$, or ISO iron mass $\geq 10^{-17}M_\odot$, if $\alpha < 4$. This iron mass is larger than the accretion mass of interstellar medium (ISM) by several orders of magnitude. Taking into account material mixing in a convection zone of Pop.~III survivors, we obtain their surface pollution is typically [Fe/H] ≤ -8 in most cases, however the surface pollution of Pop.~III survivors with $0.8M_\odot$ can be [Fe/H] ≥ -6 because of the very shallow convective layer. We first show the importance of ISOs for the metal pollution of Pop.~III survivors.

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Talk/Poster

Talk

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Session Classification: EMP Stars: Theory