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Unveiling black holes in open clusters

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Open clusters are the place where a large fraction of massive stars form, evolve, and eventually die, giving birth to stellar-mass black holes. If a significant fraction of black holes receives low (⍰ km /s) kicks at birth, even open clusters with low escape velocities can efficiently retain them. Thanks to the exquisite astrometric and photometric measurement by *Gaia*, we have now the opportunity to infer the presence of these black holes from the imprints they leave on the observable properties of the host cluster.

In my contribution, I will present the very first attempt to search for signatures of black holes in the nearest open cluster to the Sun, the Hyades. I will compare the stellar mass distributions from direct N–body models to those derived from the high-precision data by Gaia. Specifically, I will quantify the impact of black holes on the mass and kinematic profiles of the stars, and on the structure of the tidal tails. By this comparison, I will estimate whether a central black hole component is required to match the observed stellar distributions.

My results indicate that, at the present day, the radial mass distribution of stars provides the most effective tracer to find signatures of black holes in open clusters. For the Hyades, the observations are best reproduced by models with 2–3 black holes at present. Models that have never possessed black holes have an half-mass radius ~ 30% smaller than the observed value, while those where the last black holes were ejected ⍰ 150 Myr ago can still reproduce the density profile. Thus, the Hyades present-day structure requires a significant fraction of black holes to form with low kicks (< 3 km/s) to match the observations.

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