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How many forming planets in the transitional disk around AB Aurigae ?

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AB Aur is a bright and young Herbig Ae star surrounded by a broad transitional disk, with a long record of detailed observations at various wavelengths. Multiple direct and indirect evidences for the presence of embedded proto-planets have been reported in the recent years in this system. A prominent double spiral pattern was first detected with ALMA in the molecular line emission of CO gas, with a large pitch angle in the most inner region, suggesting the presence of at least one sub-stellar body within the cavity of the dusty disk ($R < 120 \text{ au}$). We obtained two epochs of observations of AB Aur with VLT/SPHERE (Dec. 2019 - Jan. 2022). The first polarimetric image showed a wealth of structures at several scales. Two spirals clearly overlap those detected with ALMA, although with a higher angular resolution. One of these spirals features a twist located at $0.18''$ from the star, reminiscent of structures predicted by the theory of density waves produced by a gravitational perturber onto the gas distribution. The analysis of the multi-epoch data shows changes consistent with Keplerian rotation with a protoplanet located at about 30 au from the star. In addition, localized emissions could be attributed to additional planet candidates (which are otherwise expected in order to carve the large disk cavity), including the recent claim of a super-Jupiter near 90 au from high-contrast near-IR imaging with Subaru-SCExAO. All these pieces of evidence make AB Aur one of the most promising young sources to investigate planet-disk interactions, and to unveil the close environment of accreting planets. I will report on the global (and detailed) analysis of the new observational results for this nascent planetary system, both in the context of the multi-epoch, and multi-wavelength SPHERE+ALMA images, and with the contribution of multi-fluid hydrodynamical simulations.