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A Search for Planet Nine with IRAS and AKARI Data

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The outer solar system is theoretically predicted to harbour an undiscovered planet, often referred to as P9. Simulations suggest that its gravitational influence could explain the unusual clustering of minor bodies in the Kuiper Belt. However, no observational evidence for P9 has been found so far, as its predicted orbit lies far beyond Neptune, where it reflects only a faint amount of Sunlight. This work aims to find P9 candidates by taking advantage of two far-infrared all-sky surveys, which are IRAS and AKARI. The epochs of these two surveys were separated by 23 years, which is large enough to detect the ~3'/year orbital motion of P9. We use a dedicated AKARI Far-Infrared point source list for our P9 search - AKARI Monthly Unconfirmed Source List, which includes sources detected repeatedly only in hours timescale, but not after months. We search for objects that moved slowly between IRAS and AKARI detections given in the catalogues. First, we estimated the expected flux and orbital motion of P9 by assuming its mass, distance, and effective temperature to ensure it can be detected by IRAS and AKARI, then applied the positional and flux selection criteria to narrow down the number of sources from the catalogues. Next, we produced all possible candidate pairs whose angular separations were limited between 42' and 69.6', corresponding to the heliocentric distance range of 500 - 700 AU and the mass range of 7 - 17 Earth masses. There are 13 pairs obtained after the selection criteria. After image inspection, we found one good candidate, of which the IRAS source is absent from the same coordinate in the AKARI image after 23 years and vice versa. However, AKARI and IRAS detections are not enough to determine the full orbit of this candidate. This issue leads to the need for follow-up observations, which will determine the Keplerian motion of our candidate.

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Other

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