Effect of Radiative Levitation on Calculations of Accretion Rates in White Dwarfs

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Elements heavier than hydrogen or helium that are present in the atmospheres of white dwarfs with $T_{\rm eff} \leq$ 25,000 K are believed to be the result of accretion. By measuring abundances in such white dwarfs and by assuming a steady state accretion, we can derive the composition of the accreted matter and infer its source. The presence of radiative levitation, however, may affect the determination of the accretion rate. We present time-dependent diffusion calculations that take into account radiative levitation and accretion. The calculations are performed on C, N, O, Ne, Na, Mg, Al, Si, S, Ar, and Ca in hydrogen-rich white dwarf models with $T_{\rm eff} \leq$ 25,000 K and a gravity of $\log g = 8.0$. In presence of a weak accretion, we show that the abundance of an element supported by the radiative levitation is given by the equilibrium between the radiative and gravitational accelerations. In that case, the prediction of the accretion rate from the observed abundance under the assumption of a steady state accretion may be overestimated.