独立行政法人理化学研究所　仁科加速器研究センター
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Imaginary time theory for triple-alpha reaction rate

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Triple-alpha thermonuclear reaction rate is recently discussed with various theoretical methods at a low temperature region (below 0.1 GK), where experimental date is
not available. The calculation by CDCC method predicts much larger reaction rate by 10^{25} at 0.01 GK, than a standard estimation by NACRE compilation, which is usually utilized for investigating evolutions of stars. It is thus very important to give predictions from other theoretical methods to solve this discrepancy. For this purpose, we introduce a new theoretical approach based on an imaginary-time method, which has an advantage that the knowledge of a boundary condition of three-charged particles is not required. We show that our result is consistent with the NACRE compilation for whole temperature region from 1 GK to 0.01 GK. We also show that a truncation of a channel number in a coupled-channel method gives a rise to a large enhancement of the reaction rate at a low temperature region.

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