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Accurate prediction of clock transitions in a highly charged ion with complex electronic structure[1] CHARLES CHEUNG, MARIANNA SAFRONOVA, SERGEY PORSEV, University of Delaware, MIKHAIL KOZLOV, Petersburg Nuclear Physics Institute of NRC "Kurchatov Institute", ILYA TUPITSYN, St. Petersburg State University, ANDREY BONDAREV, Center for Advanced Studies, Peter the Great St. Petersburg Polytechnic University — We have developed a broadly-applicable approach that drastically increases the ability to accurately predict properties of complex atoms. We applied it to the case of Ir^{17+}, which is of particular interest for the development of novel atomic clocks with high sensitivity to the variation of the fine-structure constant and dark matter searches. The clock transitions are weak and very difficult to identity without accurate theoretical predictions. In the case of Ir^{17+}, even stronger electric-dipole ($E1$) transitions eluded observation despite years of effort raising the possibility that theory predictions are grossly wrong. In this work, we provide accurate predictions of transition wavelengths and $E1$ transition rates in Ir^{17+}. Our results explain the lack of observation of the $E1$ transitions and provide a pathway towards detection of clock transitions. Computational advances demonstrated in this work are widely applicable to most elements in the periodic table and will allow to solve numerous problems in atomic physics, astrophysics, and plasma physics.

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