Le, Dai-Nam; Phan, Ngoc-Hung; Thoi, Tuan-Quoc N.; Le, Van-Hoang
Parabolic, prolate spheroidal bases and relation between bases of the nine-dimensional
MICZ-Kepler problem. (English) [Zbl 1416.81057]

Summary: The nine-dimensional MICZ-Kepler problem (9D MICZ KP) considers a charged particle
moving in the Coulomb field with the presence of a SO(8) monopole in a nine-dimensional space. This
problem received much effort recently, for example, exact solutions of the Schrödinger equation of the
9D MICZ KP have been given in spherical coordinates. In this paper, we construct parabolic and prolate
spheroidal basis sets of wave functions for the system and give the explicit interbasis transformations and
relations between spherical, parabolic, and prolate spheroidal bases. To build the parabolic and prolate
spheroidal bases, we show that the Schrödinger equation of the considered system is also variable separable
in both parabolic and prolate spheroidal coordinates, and then, solve this equation exactly. The variable
separability in different coordinate systems is actually a consequence of the superintegrability which has
been proved recently for the 9D MICZ KP.

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MSC:
81Q05 Closed and approximate solutions to the Schrödinger, Dirac, Klein-Gordon and other equations of quantum mechanics
81V45 Atomic physics
78A30 Electro- and magnetostatics
78A35 Motion of charged particles
70M20 Orbital mechanics
70G10 Generalized coordinates; event, impulse-energy, configuration, state, or phase space for problems in mechanics
81U15 Exactly and quasi-solvable systems arising in quantum theory

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magnetic monopole

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DLMF

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References: