

## Mathematical Physics

# Third order superintegrable systems separating in polar coordinates

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A complete classification is presented of quantum and classical superintegrable systems in  $E_2$  that allow the separation of variables in polar coordinates and admit an additional integral of motion of order three in the momentum. New quantum superintegrable systems are discovered for which the potential is expressed in terms of the sixth Painlevé transcendent or in terms of the Weierstrass elliptic function.

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