

SpheroidalEigenvalue

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Notations

Traditional name

Eigenvalue of the spheroidal wave functions

Traditional notation

$$\lambda_{\nu,\mu}(\gamma)$$

Mathematica StandardForm notation

SpheroidalEigenvalue[ν , μ , γ]

Primary definition

11.16.02.0001.01

$$\lambda_{\nu,\mu}(\gamma)$$

$\lambda = \lambda_{\nu,\mu}(\gamma)$ is the spheroidal eigenvalue of degree ν and order μ of the corresponding Sturm-Liouville wave differential equation $(1 - z^2) w''(z) - 2z w'(z) + (\lambda + \gamma^2(1 - z^2) - \mu^2 / (1 - z^2)) w(z) = 0$. The parameter ν enumerates the spheroidal eigenvalues in such a manner, that in the spherical limit ($\gamma \rightarrow 0$), the eigenvalues are $\lambda_{\nu,\mu}(0) = \nu(\nu + 1)$. $\lambda_{\nu,\mu}(\gamma)$ is an analytical function of the variables ν , μ and γ .

Specific values

Specialized values

For fixed ν , μ

11.16.03.0001.01

$$\lambda_{\nu,\mu}(0) = \nu(\nu + 1)$$

For fixed ν , λ

11.16.03.0002.01

$$\lambda_{\nu, -\frac{1}{2}}(\gamma) = -\frac{\gamma^2}{2} - \frac{1}{4} + a_{\nu+\frac{1}{2}}\left(\frac{\gamma^2}{4}\right)$$

11.16.03.0003.01

$$\lambda_{\nu, \frac{1}{2}}(\gamma) = -\frac{\gamma^2}{2} - \frac{1}{4} + a_{\nu+\frac{1}{2}}\left(\frac{\gamma^2}{4}\right)$$

For fixed λ

11.16.03.0004.01

$$\lambda_{0,1}(\gamma) = 0$$

11.16.03.0005.01

$$\lambda_{0,2}(\gamma) = 1 - \sqrt{1 - 4\gamma^2}$$

11.16.03.0006.01

$$\lambda_{1,2}(\gamma) = 1 + \sqrt{1 - 4\gamma^2}$$

General characteristics

Domain and analyticity

$\lambda_{\nu,\mu}(\gamma)$ is an analytical function of ν , μ and γ which is defined in \mathbb{C}^3 .

11.16.04.0001.01

$$(\nu * \mu * \gamma) \rightarrow \lambda_{\nu,\mu}(\gamma) :: (\mathbb{C} \otimes \mathbb{C} \otimes \mathbb{C}) \rightarrow \mathbb{C}$$

Symmetries and periodicities**Parity**

11.16.04.0002.01

$$\lambda_{-\nu,\mu}(\gamma) = \lambda_{\nu-1,\mu}(\gamma)$$

11.16.04.0003.01

$$\lambda_{\nu,-\mu}(\gamma) = \lambda_{\nu,\mu}(\gamma)$$

Mirror symmetry

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$$\lambda_{\bar{\nu},\bar{\mu}}(\bar{\gamma}) = \overline{\lambda_{\nu,\mu}(\gamma)}$$

Periodicity

No periodicity

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