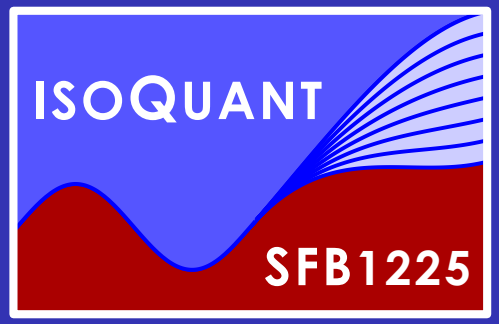


Two-loop self-energy corrections to the g-factor of bound electrons

Bastian Sikora[1], Vladimir A. Yerokhin[1,2], Natalia S. Oreshkina[1], Halil Cakir[1], Niklas Michel[1], Vincent Debierre[1], Nikolay A. Belov[1], Jacek Zatorski[1], Zoltán Harman[1], Christoph H. Keitel[1]

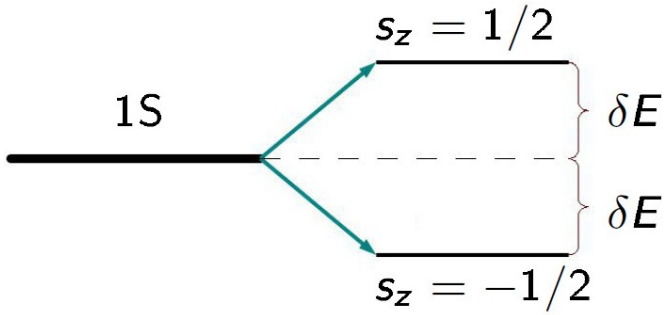
[1]Max Planck Institute for Nuclear Physics, Heidelberg, Germany
[2]Peter the Great St. Petersburg Polytechnic University, St. Petersburg, Russia

FFK-2019
June 12, 2019

g-factor — definition

g-factor of bound electron in ground state $|1s\rangle$ of hydrogenlike ion:

$$\boldsymbol{\mu}_{\mathrm{e}} = g\frac{e\boldsymbol{J}}{2m_e}\,; \qquad \delta E = -\langle 1s|\boldsymbol{\mu}_{\mathrm{e}}\boldsymbol{B}|1s\rangle = -g\frac{eB}{4m_e}$$



δE: energy splitting due to external magnetic field $\boldsymbol{B}$ (Zeeman effect)

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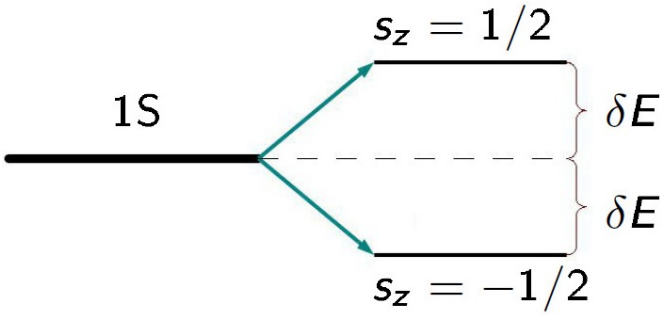

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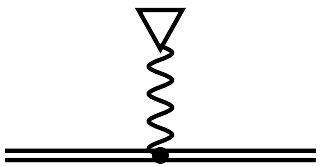

$$\Delta E_\mathrm{mag} = -\frac{2}{3}i\int \mathrm{d}r\, r^2\, \mathit{Bier}\, f(r)g(r)$$

$$g_\mathrm{D} = \frac{2}{3} + \frac{4}{3}\sqrt{1-(Z\alpha)^2}$$

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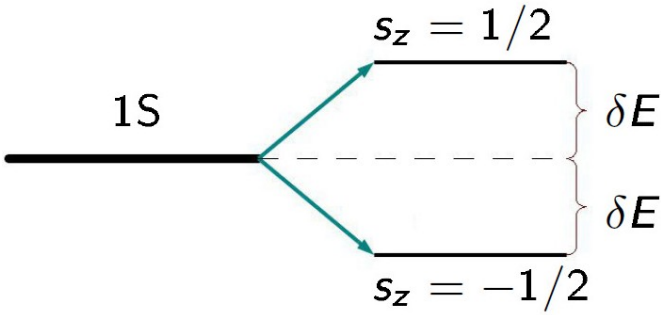

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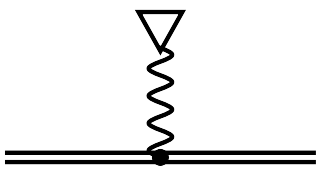

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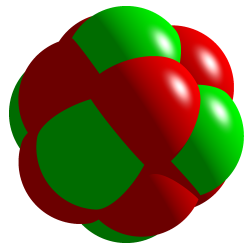

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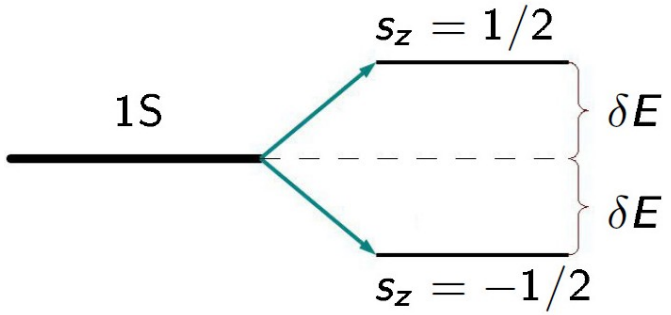

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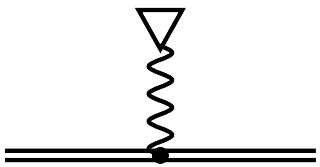

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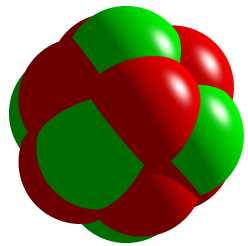
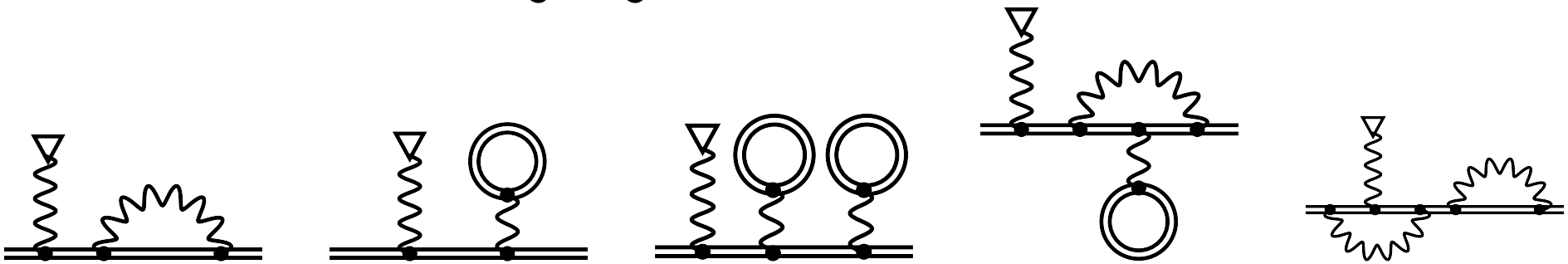
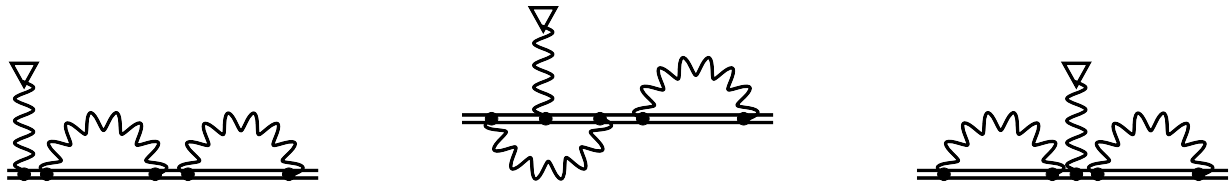




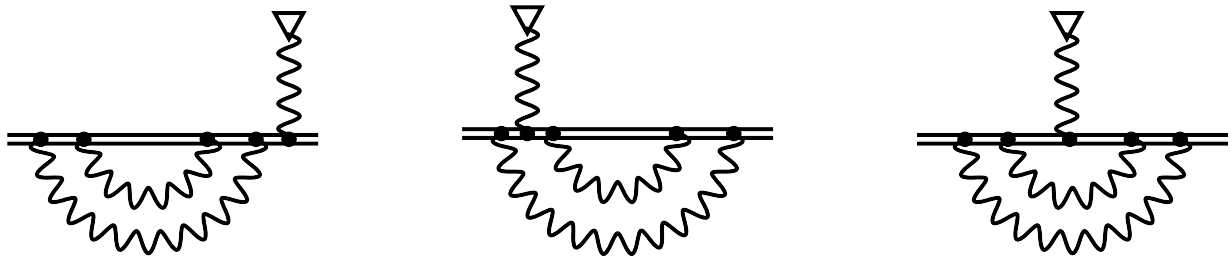
Two-loop self-energy (SESE) diagrams

Largest uncertainty in theoretical g-factor predictions due to uncalculated SESE diagrams

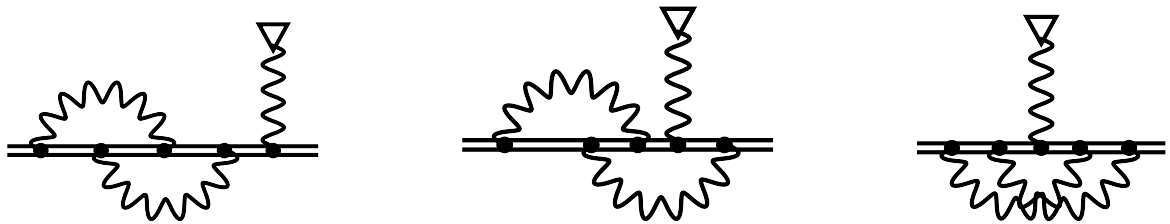
Loop after loop (LAL):



Nested loop (NL):



Overlapping loop (OL):



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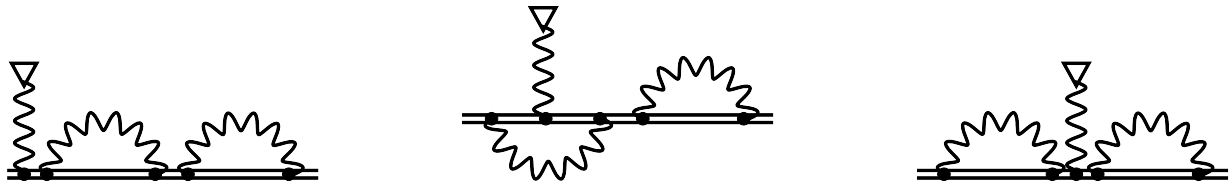

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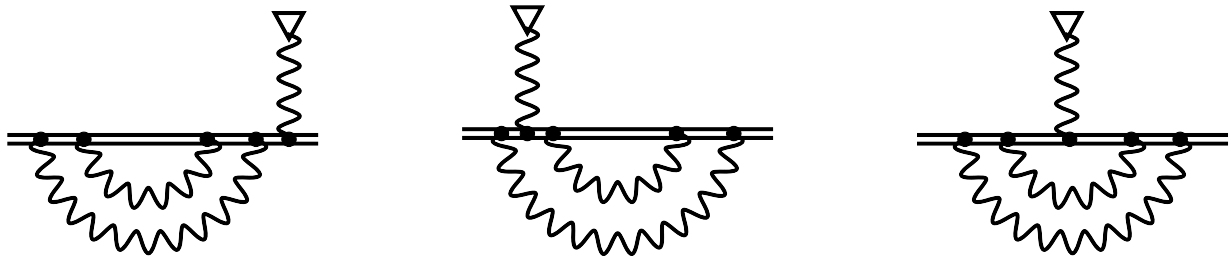

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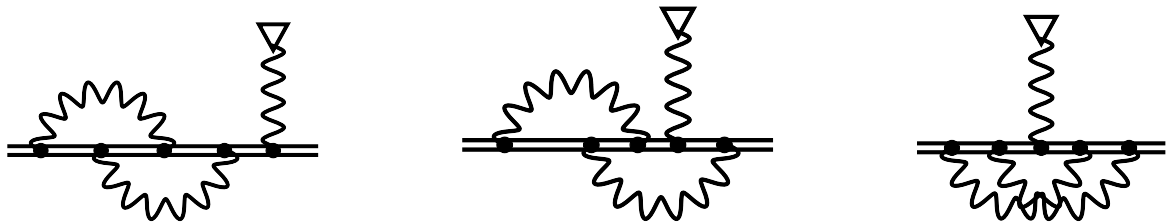

Separation of two-loop SESE into **LAL**, **F**, **P**, **M**

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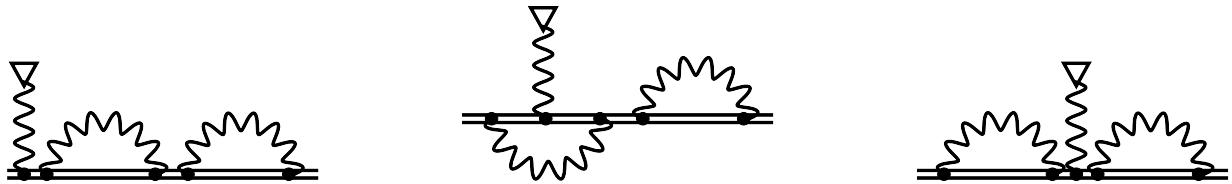

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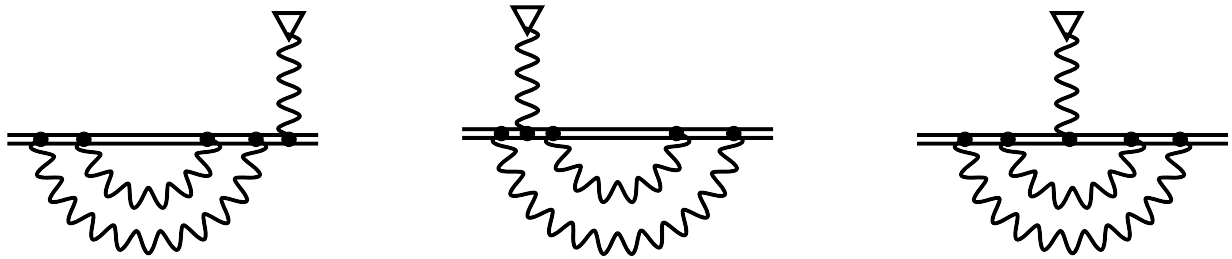

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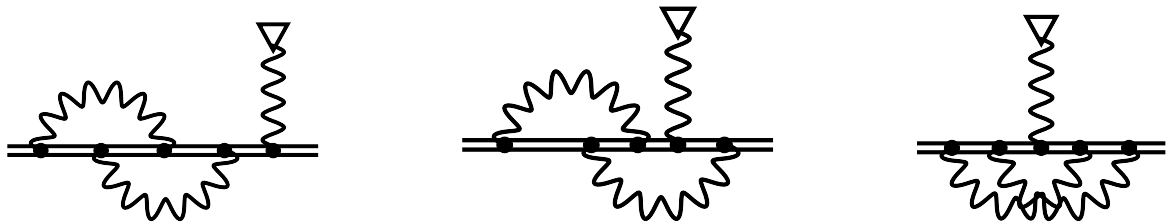

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Done Ongoing