Remarks on bound states in perturbation theory

Hadrons are regarded as non-perturbative bound states of QCD.
Atoms may likewise be viewed as non-perturbative bound states of QED:

- There is no Positronium pole in any $e^+e^- \to e^+e^-$ Feynman diagram.
- Positronium wave functions are exponential in α.
- Binding energies are expanded in powers of α and $\log\alpha$.

Hadrons resemble atoms in many respects, despite their strong binding,
color confinement and spontaneously broken chiral symmetry:

- Heavy quarkonia are well described by the Schrödinger equation.
- Hadron quantum numbers are determined by the valence quarks ($q\bar{q}$, qqq).
- Hadrons have narrow and selective decay widths (the OZI rule).

Field theory textbooks should address issues like:

- How is the Schrödinger equation for atoms derived in QED?
- What is the wave function of a Positronium atom in motion?
- What states do Dirac wave functions describe?

Perturbative methods for bound states complement those of scattering amplitudes.
Including them in lecture courses will support the study of hadrons in QCD.

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