PHYS 261 ATOMIC PHYSICS PART
FINAL REVISION. Not too different from preliminary version,
mostly only clarified or shortened

There are **3 large topics** and **4 short topics**
Combinations of the type

TOPIC 1 and A
TOPIC 3 and B
but not, for example TOPIC 1 and B (overlapping)

will be prepared and drawn at the exam

In addition, if time permits, the candidate can be asked to add a short presentation of a topic of own choice, which might even not be listed here at all. This is the candidate's own choice, in addition to the short and long question.

TOPIC 1 lecture of about 20 minutes
Helium and helium−like atoms (ions)

- spin − its role
- singlet, triplet
- why are triplet states lower in energy
- binding energy, independent model
- electron repulsion
- Variational method
  - Systematic features from H− to C4+ (table provided)
- Other (variatinal) methods; Hylleraas

TOPIC 2 lecture of about 20 minutes
Many Electron Atoms

- selfconsistent fields
- Hartree method
- Variational methods, Hartree Fock
- periodic system
- Configurations, configuration mixing

TOPIC 3 lecture of about 20 minutes
Interaction of radiation and Matter

- short on energy exchange, time development
  Decay of a state, Fermi Golden Rule
  - Exponential decay, Line widths
- The two interacting systems − atom and the field
  - Field eigenmodes, Quantization of the field
  - Interaction between the two systems
- Some details of the evaluation
- Qualitative discussion, point out main features
  (transparency with results provided)

TOPIC A. (about 5−10 minutes) **Golden Rule and Line−widths, Exponential Decay**

- From Fermi Golden Rule to exponential decay
- From Fermi Golden Rule to linewidths

TOPIC B. (about 5−10 minutes) **The role of spin and symmetry in 2−electron systems**

- singlet, triplet
- effective spin−spin interaction vs. real spin−spin

TOPIC C. (about 5−10 minutes) **Stability of Molecules**

- why are molecules stable
- electron states in more than one atom
- correlation diagrams
- if time permits, vibrational and rotational spectra

TOPIC D. (about 5−10 minutes) **Hartree's Selfconsistent fields, Periodic System**

- Concept of Hartree's Selfconsistent fields
- Features of the potential, Periodic System