

## LECTURES ON MAGNETISM by Luigi Paolasini

Lectures will be given in the ESRF Auditorium from 14:00 to 15:00.

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|---|------------------|
| <b>Lecture 1: “Why spins spin”</b>                              | 14 JANUARY 2014  |
| - Historical view.  |                  |
| - Classical and quantum mechanics.                              |                  |
| - Self-rotating electron model.                                 |                  |
| - Spin algebra and coupling of two spins.                       |                  |
| <b>Lecture 2: “Lonely atoms”</b>                                | 28 JANUARY 2014  |
| - Fine structure and spin-orbit interaction.                    |                  |
| - Hund’s rules.   |                  |
| - Magnetic susceptibility: diamagnetism and paramagnetism.      |                  |
| - Rare Earth ions and L-S coupling.                             |                  |
| <b>Lecture 3: “Local perturbations”</b>                         | 11 FEBRUARY 2014 |
| - Crystal field and orbital quenching.                          |                  |
| - Jahn-Teller effect.   |                  |
| - Magnetic resonance techniques.                                |                  |
| - Electron spin resonance, Mössbauer and muon-spin relaxation.  |                  |
| <b>Lecture 4: “Magnetic interactions”</b>                       | 11 MARCH 2014    |
| - Dipole and exchange magnetic interactions.                    |                  |
| - Direct and indirect exchange interactions.                    |                  |
| - Anisotropic exchange interactions.                            |                  |
| - Interplay between orbital and magnetic order.                 |                  |
| <b>Lecture 5: “Magnetic structures”</b>                         | 25 MARCH 2014    |
| - Mean-field magnetization and Curie-Weiss models.              |                  |
| - Ferromagnetic and Antiferromagnetic order                     |                  |
| - Collinear and non-collinear magnetic structures.              |                  |
| - Magnetic domains.   |                  |
| <b>Lecture 6: “The dark side of magnetism: magnetic metals”</b> | 8 APRIL 2014     |
| - Free electron gas model.                                      |                  |
| - Magnetism in metals.  |                  |
| - Itinerant exchange interactions.                              |                  |
| <b>Lecture 7: “Magnetic excitations”</b>                        | 22 APRIL 2014    |
| - Phase transitions and the Landau mean-field theory.           |                  |
| - Heisenberg and Ising models.                                  |                  |
| - Magnetic excitations in magnetic itinerant systems.           |                  |
| <b>Lecture 8: “Competing interactions”</b>                      | 6 MAY 2014       |
| - Frustrated magnetism.   |                  |
| - Low dimensional magnetism                                     |                  |
| - Confined magnetic systems                                     |                  |
| <b>Lecture 9: “X-ray magnetic scattering”</b>                   | 27 MAY 2014      |
| - X-rays-photon interactions.                                   |                  |
| - Non-resonant magnetic x-ray scattering.                       |                  |
| - Resonant magnetic scattering.                                 |                  |
| <b>Lecture 10: “Other x-ray techniques for magnetism”</b>       | 17 JUNE 2014     |
| - Resonant inelastic magnetic x-ray scattering.                 |                  |
| - Magneto-optical spectroscopy.                                 |                  |
| - Conclusions and possible extensions of the program.           |                  |

THE LECTURE NOTES COULD BE FOUND IN: <http://www.esrf.eu/events/Seminars>  
PARTICIPANTS WHO HAVE NO BADGES ALLOWING ENTRANCE TO THE ILL-ESRF SITE  
ARE REQUESTED TO CONTACT [Eva Jahn](mailto:Eva.Jahn@esrf.eu), tel +33 (0)4 76 89 26 19.