In November 2016, I will give a course

"The Kerr metric for students of astrophysics".

My lecturers will be given on Tuesdays and Fridays, always 11:00-13:00, and the same day after lunch 15:00-16:00, meaning six hours per week. **The first lecture will be on Friday, 4th November**, the last lecture will be on Friday, 25th November. NOTE: as Friday, 11th November is a holiday, the three Friday 11th November lectures will be one day earlier, on Thursday, 10th November.

The course will be a comprehensible and complete description of these properties of the Kerr geometry that are most relevant for astrophysics, in particular theory of geodesic (and non-geodesic) orbits of particles and photons, theory of fluid bodies orbiting the Kerr black holes (introduction to thin disks, adafs, slim disks, Polish doughnuts), and the Penrose process (standard and electromagnetic, i.e. Blandford-Znajek). I will also touch some more mathematically advanced issues (quasi-normal oscillations of the Kerr black hole in applications to gravitational wave detection – i.e. ringdowns).

I assume NO pre-knowledge of Einstein's general relativity, and will start with a solid, but pedagogical, introduction to mathematical concepts in the relativity theory. I will lecture slowly at the blackboard, deriving everything line by line, and making sure that students do understand and follow.

I will explain everything in the classroom, and no extra homework will be needed to follow the course. Each week after the Tuesday lecture there will be one hour of consultations for those who need an extra help. Students may of course come to my office at any time and ask questions.

I will prepare a detailed lecture notes for each lecture. It will be ready before each lecture in a written form. There is no text book for my course, the lecture notes will suffice.

Part I: Introduction to Einstein's theory:

Fri 04....Spacetime, metric, Lorentz transformations, Doppler effect,
           Covariant derivative, curvature, acceleration, geodesic motion,
           geodesic deviation
Tue 08...Einstein field equations, Hilbert-Einstein action, stress-energy tensor for
           different forms of matter, Killing symmetries and conservation laws

Part II: The Schwarzschild and Kerr spacetimes:

Thu 10..(14:00-17:00) The Schwarzschild spacetime (vacuum and interior), horizon,
           Carter diagram, radial and circular geodesic motion, optical geometry,
Tue 15...The Kerr spacetime, ergosphere, the standard Penrose proces, circular
           geodesic motion at equatorial plane, epicyclic frequencies, general
           geodesic motion
Fri 18....Thin disks, adafs, slim disks
Tue 22...Polish doughnuts, jets, a non-standard Penrose, Blandford-Znajek
Fri 25....Gravitational radiation, Black holes quasi-normal modes

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