Classical and Quantum Integrable Systems

- **Session 1 [2 hours]**
  Classical integrability part 1: Liouville theorem, examples of classically integrable dynamical systems, superintegrability (1 hour) [1];
  Lax pair, monodromy and transfer matrix, example of the Non-Linear Schrödinger Equation (NLS) (1 hour) [1, 2].

  **Prerequisites:** Classical Mechanics

- **Session 2 [2 hours]**
  Classical integrability part 2: Classical $r$-matrices, Belavin-Drinfeld theorems, non-local charges, example of the Principal Chiral Model (1 hour) [1, 3];
  Classical inverse scattering method, solitons (1 hour) [1, 3].

  **Prerequisites:** Lie algebras

- **Session 3 [2 hours]**
  Quantum integrability part 1: Hopf algebras and universal $R$-matrix, quantum groups, example of $U_q(\text{su}(2))$ (1 hour) [4];
  RTT relations, Algebraic Bethe Ansatz, example of the NLS (1 hour) [5–7].

  **Prerequisites:** Quantum Mechanics

- **Session 4 [2 hours]**
  Quantum integrability part 2: Exact S-matrices, bound states, perturbation theory of the NLS (1 hour) [8, 9];
  Coordinate Bethe ansatz and Thermodynamic Bethe ansatz (1 hour) [10].

  **Prerequisites:** Classical and Quantum Statistical Mechanics

- **Session 5 [2 hours]**
  Quantum integrability part 3: massless scattering and massless flows, example of the Tricritical to Critical Ising Model (1 hour) [11];
  Quantisation of the Kadomtsev-Petviashvili equation (1 hour) [12].

  **Prerequisites:** Quantum Field Theory


