

**MATH 4810/5810 Hilbert Spaces  
Course Projects**

**August 2022**

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1. The EPR paradox and Bell's inequality (Daniel, Tuesday 08/16)
2. The Dirac Operator (Dominick, Tuesday 08/16)
3. Quantum Logic from a mathematical point of view (Marissa, Tuesday 08/16)
4. The experiments by Alain Aspect et al. which confirmed Bohr's interpretation of quantum mechanics
5. Pauli's derivation of the spectrum of the hydrogen atom (Nate B., Wednesday 08/17)
6. The Theorem of Stone–Weierstraß (Tuscany, Wednesday 08/17)
7. Fourier analysis in Hilbert spaces: Fourier series and the Legendre polynomials (Ford, Wednesday 08/17)
8. Orthogonal polynomials: Laguerre and Hermite polynomials (Isaac, Wednesday 08/17)
9. Vibrations of a (circular) membrane (with outlook to the problem whether one can hear the shape of a drum)
10. The spin in quantum mechanics
11. Representations of  $\mathfrak{sl}(2, \mathbb{C})$  (Brooke, Tuesday 08/16)
12. The Weyl-Moyal product and deformation quantization (Dion, Thursday 08/18)
13. The geometric phase in quantum mechanics
14. Wigner's theorem
15. The Born–Oppenheimer approximation
16. Dynamical quantum phase transitions (Brandon, Thursday 08/18)
17. Bargmann's theorem (Nate W., Thursday 08/18)
18. Shor's algorithm (Huilin, Thursday 08/18)