Finance Project – Initial Plan

The next major project I will be undertaking will be focused on finance. Coming from Physics, the project will aim to demonstrate the transferable skills I possess that are directly relevant to analyst roles.

These project ideas aim to deepen my understanding of the different areas finance, be hands-on, exploratory, and directly aligned with the quantitative and analytical responsibilities found in hedge-fund and investment-research roles.

Please note the majority of these ideas are not my own, they are mostly suggestions from professionals. I intend for them to act as starting points and allow natural curiosity to lead the project direction.

Research-Based Ideas:

- How an AI-driven market bubble could form and what a burst might look like across sectors

- The impact of macroeconomic shocks (e.g., inflation spikes, rate changes) on FX volatility

- Market microstructure: how liquidity conditions change around major economic announcements

- Behaviour of large-cap tech stocks during periods of monetary tightening

- Does retail investor sentiment significantly affect short-term volatility?

- The relationship between VIX term structure and S&P 500 drawdowns

- Factor drift: how traditional factor exposures (value, momentum, quality) evolve over time

- ETF premium/discount behaviour during periods of market stress

Quantitative & Coding Projects:

- **EMA Crossover Backtest** — build and evaluate a trading strategy using moving averages; analyse drawdowns, risk-adjusted returns, and parameter sensitivity.

- **Monte Carlo Option Pricing** — simulate stochastic processes, price vanilla options, and compare Monte Carlo output to Black–Scholes analytical solutions.

- **Risk Parity Portfolio** — construct and rebalance a portfolio where volatility contributions are equal across assets; explore leverage and stability.

- **Sharpe Ratio Optimizer** — build an optimisation tool that finds allocations which maximise risk-adjusted returns, experiment with constraints and risk models.

- **Reinforcement Learning for Derivative Hedging** — train an RL agent to hedge options dynamically in changing volatility regimes.

- **Basket Trading with Bayesian Optimisation** — optimise signal parameters for multi-asset trading strategies using probabilistic search methods.

- **Robust Portfolio Optimisation (SPO)** — implement scenario-based portfolio optimisation to handle noisy covariance estimates.

- **Pairs Trading Mean Reversion Model** — identify cointegrated asset pairs and build a statistical arbitrage strategy around them.

- **Regime Detection Model** — classify market regimes using clustering or hidden Markov models, then test strategy performance in each regime.

TOP 3:

1- Monte Carlo Option Pricing

(covers probability, stochastic processes, simulations, modelling, most quant aligned)

2- Risk-Parity Portfolio + Sharpe Optimiser

(portfolio analytics, factor exposure, asset management, portfolio quant aligned)

3- A Trading Strategy Backtest

(needs to be done well to stand out, save for after other projects)