**Step A: Hardware BOM for MBT Quantum Chip Experiment**

**1. Vacuum/Rotation Chamber**

* Vacuum chamber, stainless steel or borosilicate glass
  + Suppliers: Kurt J. Lesker, Ideal Vacuum, Thorlabs
  + Budget: £1,000–£3,000
* Rotational platform (precision motorized stage, controllable RPM 1–5,000)
  + Suppliers: Newport, Thorlabs, Zaber
  + Budget: £500–£2,500
* Feedthroughs for optical fibers, electrical probes, and environmental sensors
  + Budget: £200–£600

**2. Laser and Optics**

* Laser source (single-mode, tunable wavelength, e.g. 405nm, 532nm, 780nm, or 1064nm)
  + Suppliers: Thorlabs, Coherent, Edmund Optics
  + Budget: £700–£2,000
* Beam steering optics (mirrors, adjustable mounts, lenses)
  + Budget: £300–£1,000
* Neutral density filters (for safe power tuning)
  + Budget: £50–£200

**3. Quantum Material and Substrates**

* Graphene or TMD monolayer (pre-grown, CVD, on transfer substrate)
  + Suppliers: Graphenea, 2D Semiconductors, HQ Graphene
  + Budget: £200–£800 per sample
* Substrate wafers (Si/SiO₂ or sapphire)
  + Suppliers: University stockroom, Sigma-Aldrich, MTI Corp
  + Budget: £50–£300

**4. Mounting and Positioning**

* Chip holder and 3D translation stage (for precise alignment)
  + Budget: £400–£1,500

**5. Detection and Data Acquisition**

* Photodetectors/CCD camera (for measuring laser deflection and intensity)
  + Suppliers: Thorlabs, Newport, Andor
  + Budget: £600–£2,500
* Data acquisition unit (DAQ, e.g. NI USB-DAQ, Arduino for basic logging)
  + Budget: £150–£800

**6. Environmental Monitoring**

* Temperature/humidity sensors
  + Budget: £50–£150
* Vibration isolation table
  + Budget: £1,000–£2,500 (optional but recommended for high-precision work)

**7. (Optional) In-Situ Quantum Property Measurement**

* STM/AFM probe, or micro-Raman spectrometer
  + Suppliers: Bruker, Renishaw, Oxford Instruments
  + Budget: £5,000+ (can partner with a local university for access)

**8. Miscellaneous**

* Vacuum pump (rotary vane or turbo)
  + Budget: £700–£2,000
* Power supply, cables, connectors, safety interlocks
  + Budget: £300–£800

**Total Estimate (entry-level lab, all new):**

£6,000 – £18,000

(Lower if you already have lab access; higher if you want all new, top-tier gear.

**Grant Abstract & Reviewer FAQ**

**Abstract for Grant/Outreach Application**

Title:

Experimental Realisation of Room-Temperature Quantum Materials via MBT Curvature Control

Summary:

This project will realise, for the first time, a laboratory demonstration of room-temperature quantum material coherence and laser deflection through the application of the Motion = Being Theory (MBT) curvature manipulation protocol.

We will construct a rotating vacuum environment (“particle forge”) analogous to the Casimir effect, but optimised for dynamic curvature and photon/material interaction. The first-phase target is proof-of-principle: measurable, controllable deflection of a laser beam without conventional mass-based spacetime curvature, validating MBT’s prediction of tunable quantum geometry.

Phase two applies the same platform to quantum materials (graphene, TMDs, etc.) with the goal of inducing and stabilising coherent quantum behaviour such as robust superposition or entanglement—at or near room temperature, which could dramatically lower the cost and complexity of quantum devices.

If successful, this method will open an entirely new class of quantum materials and pave the way for scalable, room-temperature quantum chips, batteries, and energy systems—potentially leapfrogging decades of incremental progress in condensed matter and quantum computing.

**Reviewer FAQ (with MBT-aligned answers)**

Q1. What exactly are you claiming to achieve that has not been demonstrated before?

A: MBT predicts that quantum coherence and laser-path manipulation can be achieved by engineering spacetime curvature via rotation and vacuum, not just by lowering temperature or applying extreme fields. This approach has not been attempted in any prior experiment. If a measurable effect is seen, it represents a new tool for quantum engineering.

Q2. Why is a rotating vacuum chamber necessary?

A: In MBT, the vacuum’s curvature is altered dynamically by rotation, simulating early-universe conditions where particle and field formation occurred from a “flat” state. This rotation enables “massless” curvature—critical for trapping or bending light, or influencing quantum materials, even at room temperature.

Q3. Are you claiming to create matter from light?

A: The ultimate MBT vision includes photon-to-matter conversion, but the first experiments are focused on (1) measurable bending of a laser beam under controlled conditions, and (2) quantum property modulation in materials. Full photon-to-matter will require further engineering and is not promised as an immediate result.

Q4. What if you see no measurable effect?

A: The initial milestone is any detectable laser path modulation beyond thermal/vibration drift, which is already a novel outcome. Even a null result in photon-to-matter is not a failure—demonstrating MBT-based curvature in quantum materials at room temperature is itself revolutionary and can be applied to quantum hardware.

Q5. What is the risk and what is the reward?

A: Risk is low-cost (standard lab kit, safe to run), with an “all upside” reward: success enables room-temp quantum tech, new fundamental physics, and a competitive advantage in quantum computing, batteries, and beyond. Failure provides valuable constraints for future MBT models.

Q6. How does this compare to existing quantum chip research?

A: Current chips require extreme cooling, complex isolation, and delicate fabrication. MBT-based chips use accessible materials (graphene, TMDs) and environmental modulation, enabling robust, scalable devices at ambient conditions—if the effect is real, the field will rapidly pivot to these protocols.

**Experimental Protocol & Measurement Plan**

Now that you have an outreach abstract and a clear pitch for reviewers, the next phase is to document the actual step-by-step experimental process and the precise measurements that will make or break the project.

This should be clear enough for any competent lab to replicate the experiment.

**Step C.1: Build and Setup**

**1. Apparatus Construction**

* Rotating Vacuum Chamber:
  + Obtain (or custom-build) a cylindrical stainless steel or glass vacuum vessel, minimum 15 cm diameter.
  + Mount the chamber on a low-friction, computer-controlled rotary stage with precise RPM control (±0.1 RPM).
  + Integrate a feedthrough for laser input/output, sensors, and vacuum lines.
  + Include optical-grade windows (quartz/sapphire) for laser ingress/egress and imaging.
* Laser System:
  + Use a continuous-wave (CW) visible laser (e.g., 532 nm green or 650 nm red, ~10 mW).
  + Mount laser so it enters chamber tangentially at mid-height, aligned with optical window.
* Vacuum System:
  + Achieve pressures <10⁻⁴ torr (standard roughing pump and turbo pump).
  + Sensors for pressure, temperature, and chamber vibration.

**2. Alignment and Calibration**

* Laser path is aligned with chamber axis at zero rotation.
* Record baseline (non-rotating, atmospheric and vacuum) beam spot position on detector screen (e.g., CMOS or CCD camera).
* Repeat for incremental RPMs under atmospheric and vacuum conditions.
* Calibrate for thermal drift and vibration by running “sham” trials (rotation without vacuum, vacuum without rotation, etc.).

**Step C.2: Experimental Run**

A. Control Measurements

* With chamber at rest, fire laser and record beam path for 5+ minutes at atmospheric pressure.
* Repeat at high vacuum.

B. Rotation Test

* Start rotation at 1 RPM. Allow system to stabilise for 30 seconds.
* Fire laser, record beam position for 1 minute.
* Increment rotation in 1 RPM steps up to (say) 30 RPM, at each step record beam path for 1 min.
* Repeat full RPM sweep under vacuum.

C. Repeatability

* Run sequence 3+ times, randomising order if possible.
* Reverse direction of rotation (CW/CCW) and observe any asymmetry.

**Step C.3: Data Analysis & Measurement Criteria**

* Primary signal:
  + Change in beam position on detector (in microns or arc-seconds) versus baseline, correlated with rotation and vacuum state.
  + Look for consistent “dip” or “shift” as predicted by MBT.
* Secondary signals:
  + Any non-GR/non-classical changes in laser profile, polarisation, or intensity.
  + Compare with control trials (thermal, vibration, etc.).
* Statistical analysis:
  + Use t-tests or ANOVA to confirm significance of shifts.
  + Estimate sensitivity: can you resolve <10 micron shifts?
* Documentation:
  + Photograph setup, log all calibration data, archive raw video and detector frames.