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Simulating motion in synthetic magnetic monopole fields

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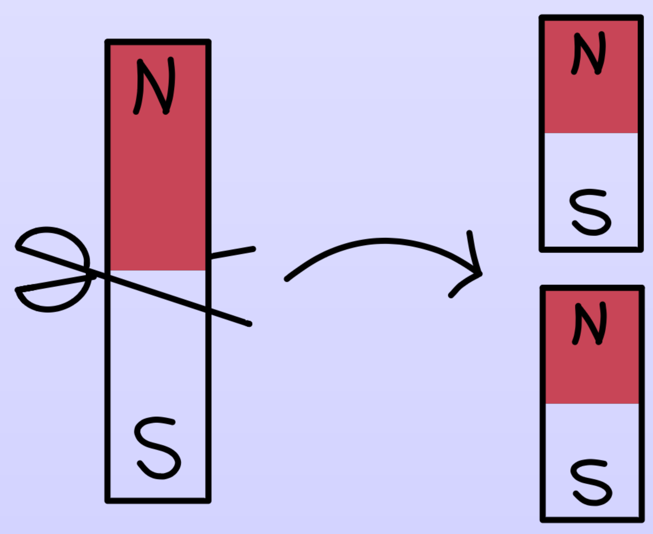
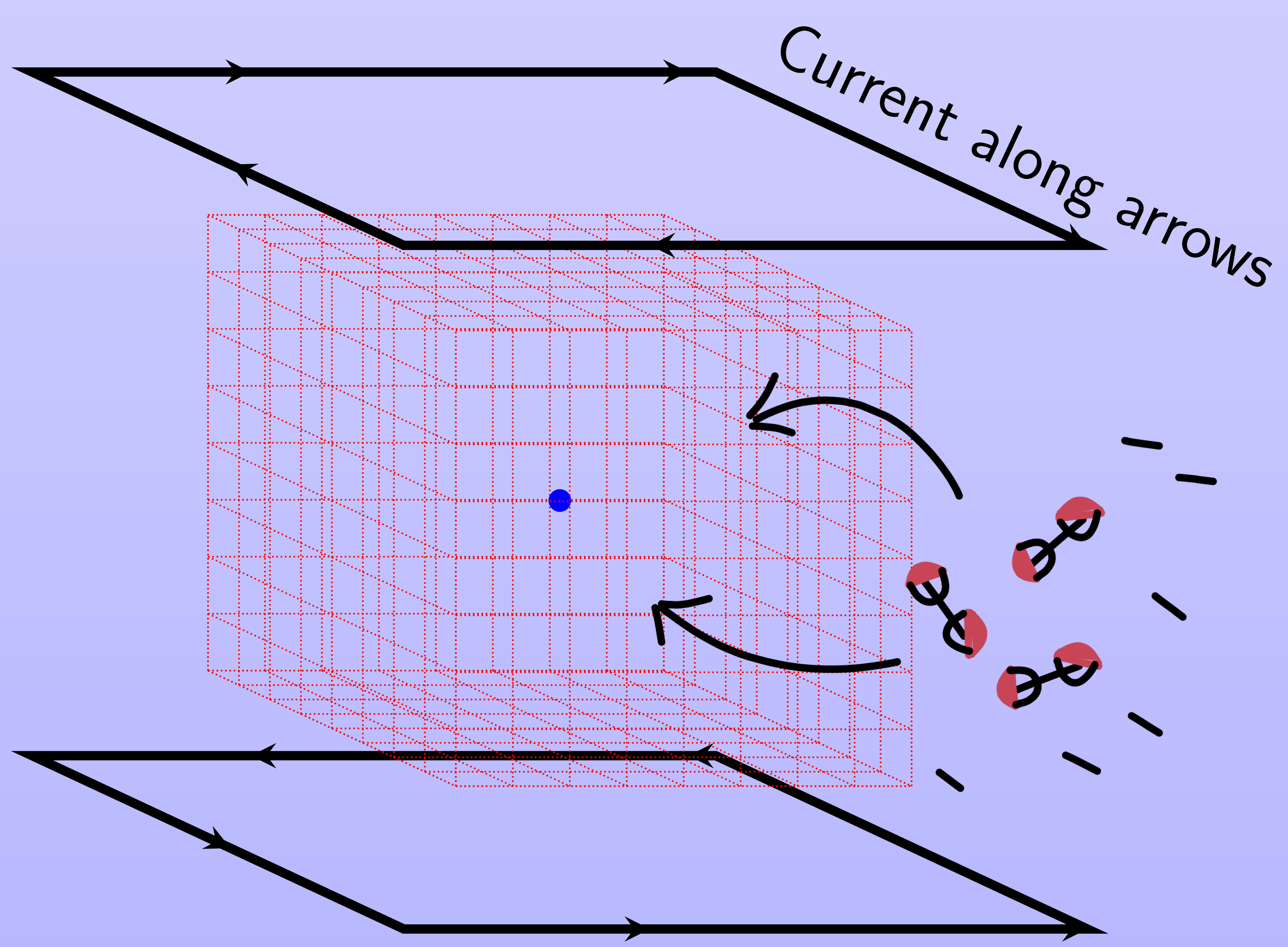
Basic principle and premise

Magnetism always appears in dual form. Any size of "magnet" must have at least two poles, much like a common bar magnet has a north pole and a south pole. Imagine splitting such a bar magnet in twine, would two pieces of different magnetic "charge" be the result, one block of pure "north" and one of pure "south"?
That would be what is called magnetic monopoles, but such things have yet never been observed, the bar magnet will split into two smaller bar magnets. Other things in nature *appear* to be monopoles even though they are not, and it is this kind of monopole which is studied here. This project concerns the modelling and simulation of a certain system with certain properties, such that its motion appears to be affected by a magnetic monopole.



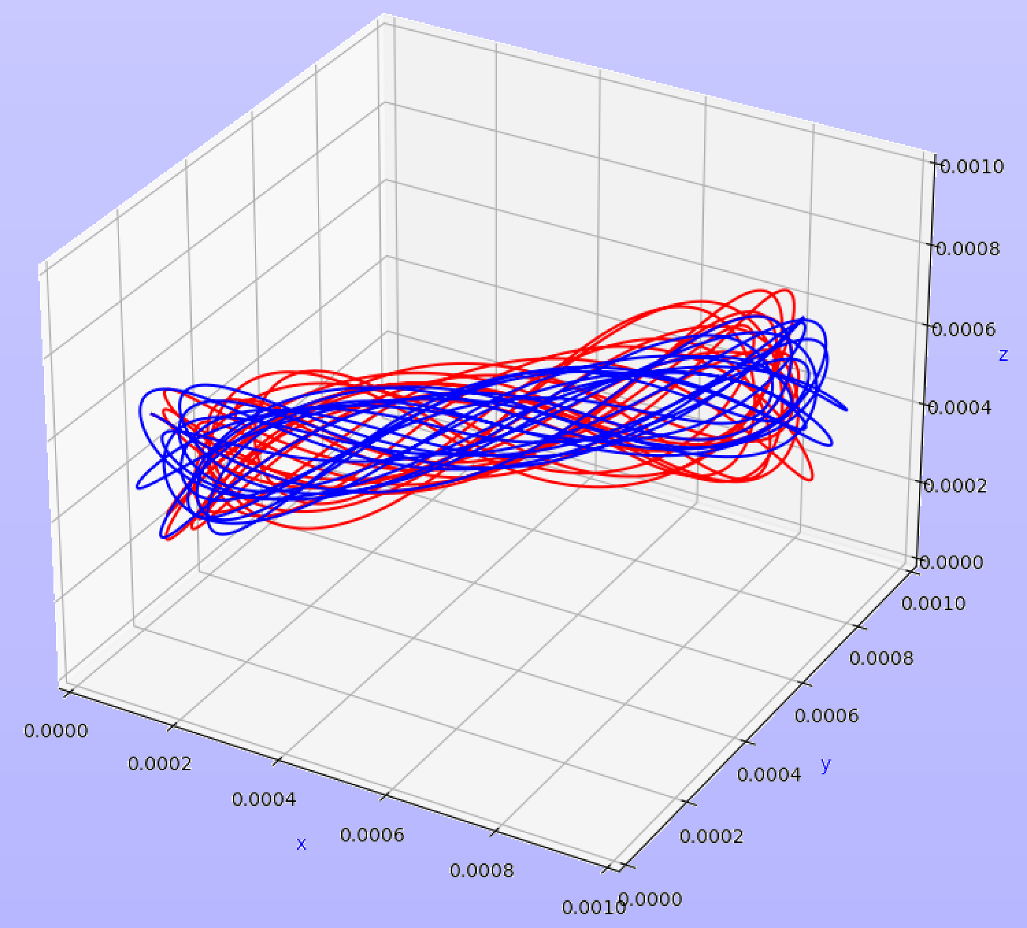
The system and setup



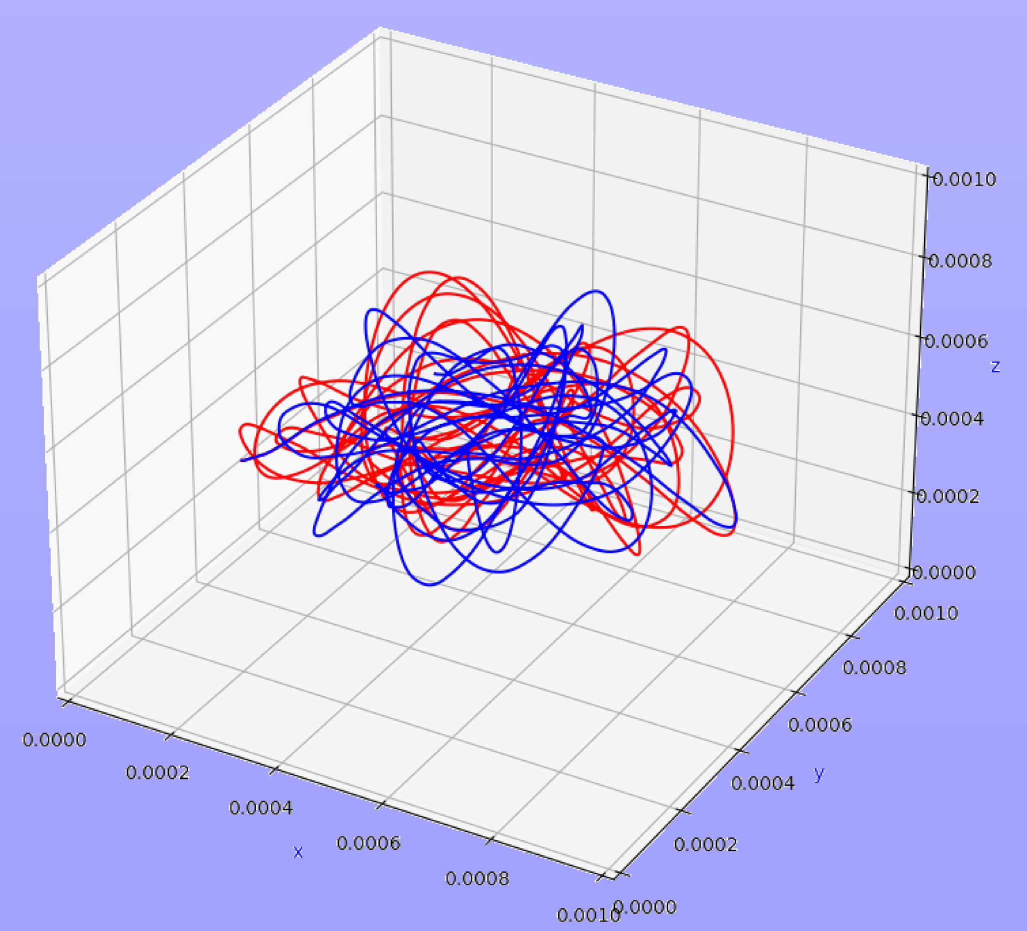
- Consider two masses connected by a massless stick, like a dumbbell for weight lifting.
- Both masses have spin, a quantum bar magnet rotating about each end of the dumbbell in a quirky "quantum way".
- The dumbbells are thrown into a magnetic field, how will they move and rotate?
- Simulations were done for a magnetic field generated by two square coils, as above.
- The red grid is the volume simulated.
- The blue dot marks a point of zero magnetic field, where a synthetic monopole emits a synthetic magnetic field.
- This synthetic field is **not** the "regular" field generated by the coils.
- Both fields affect the dumbbell motion.

Results

- The effect of the monopole was shown for several sets of parameters. Blue paths are without synthetic effects.



- Placing the dumbbell in a high energy state traps it between the coils, as shown here.



- Lower mass means more synthetic effects, as in the lower plot.