



Take the magnetic line and head south

Do birds see with quantum eyes?

MARK BUCHANAN

A QUANTUM trick might be behind birds' ability to navigate using Earth's magnetic field lines.

Some researchers think birds might be able to "see" the magnetic field via photosensitive proteins in their retinas. The theory is that when a photon strikes one of these proteins, it creates a pair of oppositely charged ions, which separate for a fleeting moment before recombining. Each of these ions contains electrons with a quantum property called spin. Initially, these spins point in opposite directions – but in a magnetic field, they tend to become aligned. When the ions recombine, this alignment triggers a specific biochemical reaction, which gives the bird information about the magnetic field.

The idea has a major flaw though. The ions seem to be

pulled back together about 10 times faster than researchers think Earth's magnetic field could affect the electrons' spins.

Now Iannis Kominis of the University of Crete in Heraklion, Greece, suggests that a known quantum effect might be able to ramp up the impact of the magnetic field in enough time. "Quantum physics comes to the rescue," he says.

The "quantum Zeno" effect occurs when repeated measurements of a quantum system are made. While these measurements are taking place particles do not change their state, as if they know they're being watched.

"The Zeno effect might be able to ramp up the impact of the Earth's magnetic field on proteins in birds' eyes"

Kominis's calculations show that the force pulling the two ions together might also induce the Zeno effect on the electrons. It would allow the magnetic field to align the spins while the ions are separated by momentarily overcoming the disturbing influences of noise in the biochemical environment, thereby amplifying the magnetic field's influence (www.arxiv.org/0804.2646).

Kominis and his colleagues have already shown that the Zeno effect can increase the sensitivity of a quantum system to a magnetic field. They did this by filling a chamber with a dense gas, thereby building a highly sensitive atomic magnetometer – a device used to detect magnetic fields.

They then applied a magnetic field so weak that many magnetometers would be unable to detect it. But because the gas was so dense, the group showed that the atoms effectively measure each other when they collide and, overall, that keeps the spin of the particles locked in the same state. This made the device strong enough to detect the magnetic field.

Other researchers doubt whether such quantum processes are at play in birds' eyes, however. "I'm a fan of daring hypotheses, but I'm not sure what this theory explains," says biologist Sonke Johnsen of Duke University in Durham, North Carolina.

He also points out that the ion reaction theory has bigger problems than the lack of time for the magnetic field to have an effect. "It's not at all clear how to make a directional sensor out of molecules that are freely diffusing and rotating," he says. In other words, the bird might be able to detect the field, but not what its orientation is.

Physicist Thorsten Ritz at the University of California, Irvine, says the idea may have merit, however. "It's really cute and worth exploring further," he says, "but I'd want to see experimental tests before I believe it."

SOUNDBITES

"I suspect Shell are somewhat embarrassed by their 'we grow flowers' claim because it's such a ridiculous claim."

The chairman of the UK **Advertising Standards Authority** commenting on the fact that oil giant Shell had implied that all its waste CO₂ was pumped into greenhouses for flower cultivation, when less than 0.5 per cent is used in this way. He says the ASA is receiving a record number of complaints about companies hyping their environmental credentials (*The Daily Telegraph*, London, 25 April)

"I have been trying to compost bags that are billed as 'biodegradable' and 'home compostable', but I have completely failed."

Chris Goodall, environmental analyst, reacting to findings that supposedly eco-friendly bioplastics are causing environmental problems (*The Guardian*, London, 26 April)

"We needed to know who he is so we can treat him properly, with the respect and dignity he deserves."

Chief **Diane Strand** of the Champagne and Aishihik First Nations tribe in Canada, speaking after DNA from a body found in a glacier was linked to 15 living people (*The Globe and Mail*, Toronto, 28 April)

"It's crazy to clone a bull in order to continue torturing and killing bulls in the rings."

Animal rights activist **Consuelo Polo** condemning plans to clone Alcalde, a stud bull used to sire animals for bullfights in Spain (CNN, 28 April)

"A nasty, aggressive sort of squid... a gelatinous blob with seriously evil arms on it."

Steve O'Shea at Auckland University of Technology, New Zealand, describing the biggest squid ever caught. Though 10 metres long, it was probably not fully grown (AFP, 29 April)