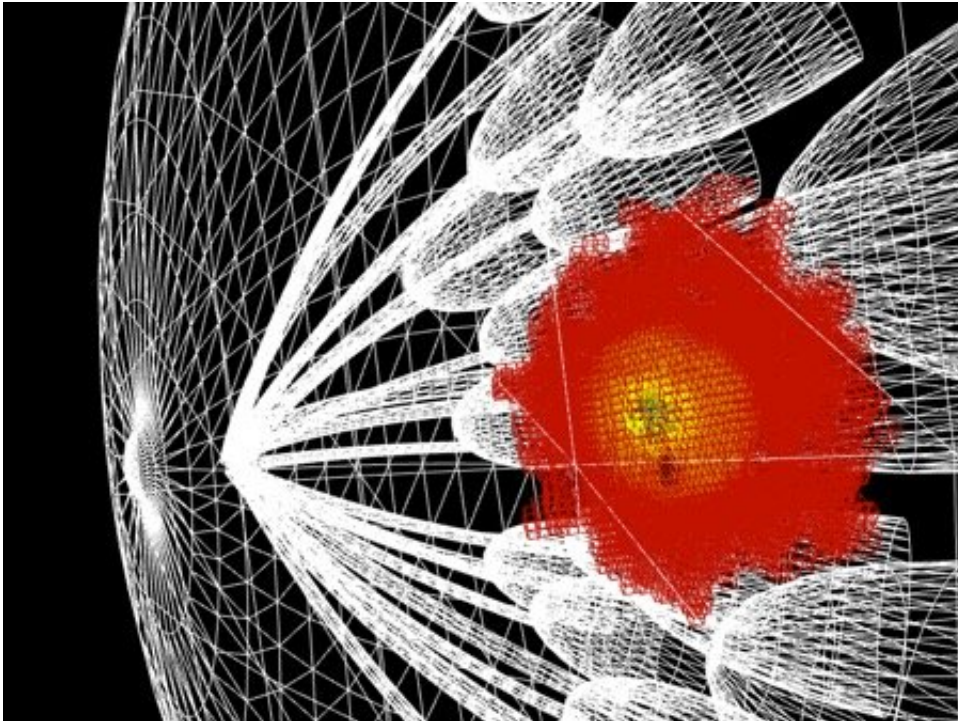


# Astronomers help wage war on cancer

July 2 2019

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A model showing light (red/yellow) penetrating the surface of the human breast (white triangles). Credit: Tim Harries

Techniques developed by astronomers could help in the fight against breast and skin cancer. Charlie Jeynes at the University of Exeter will present his and Prof Tim Harries team's work today at the RAS National Astronomy Meeting (NAM 2019) at the University of Lancaster.

A large part of astronomy depends on the detection and analysis of light. For example, scientists study the light scattered, absorbed and re-emitted

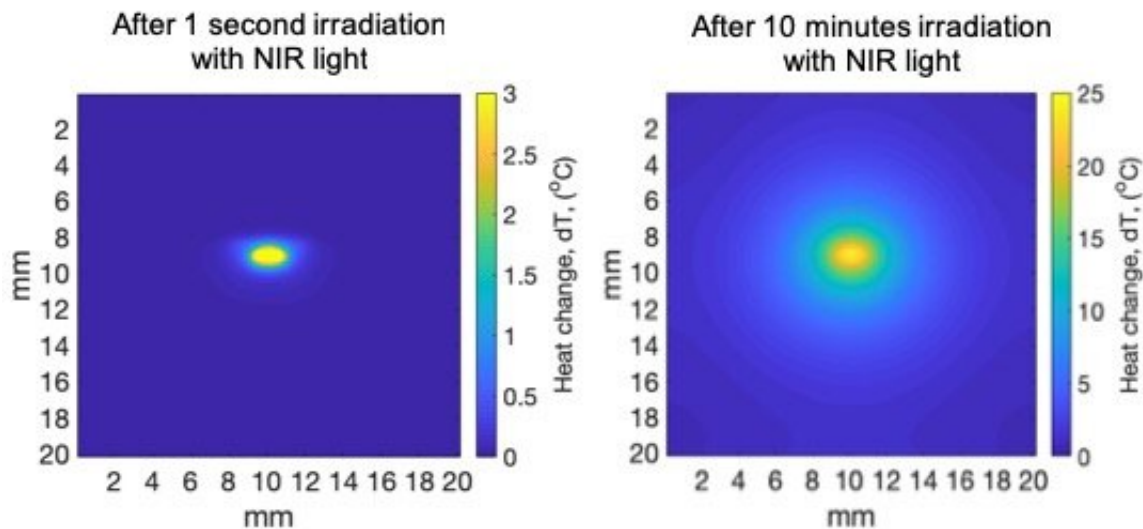
in clouds of gas and dust, obtaining information on their interior.

Despite the vast differences in scale, the processes that light undergoes when travelling through the human body are very similar to those seen in space. And when things go wrong—when tissue becomes cancerous—that change should show up.

In the UK, nearly 60,000 women are diagnosed with breast cancer each year, and 12,000 die. Early diagnosis is key, with 90% of women diagnosed at the earliest stage surviving for at least five years, compared to 15% for women diagnosed with the most advanced stage.

Cancer creates tiny deposits of calcium in breasts, detected through a shift in the wavelength of light as it passes through the tissue. The Exeter team realised that the computer codes developed to study the formation of stars and planets could be applied to find these deposits.

Charlie commented: "Light is fundamental to a diverse range of medical advances, like measuring blood oxygenation in premature babies, or treating port-wine stains with lasers. So there is a natural connection with astronomy, and we're delighted to use our work to take on cancer."



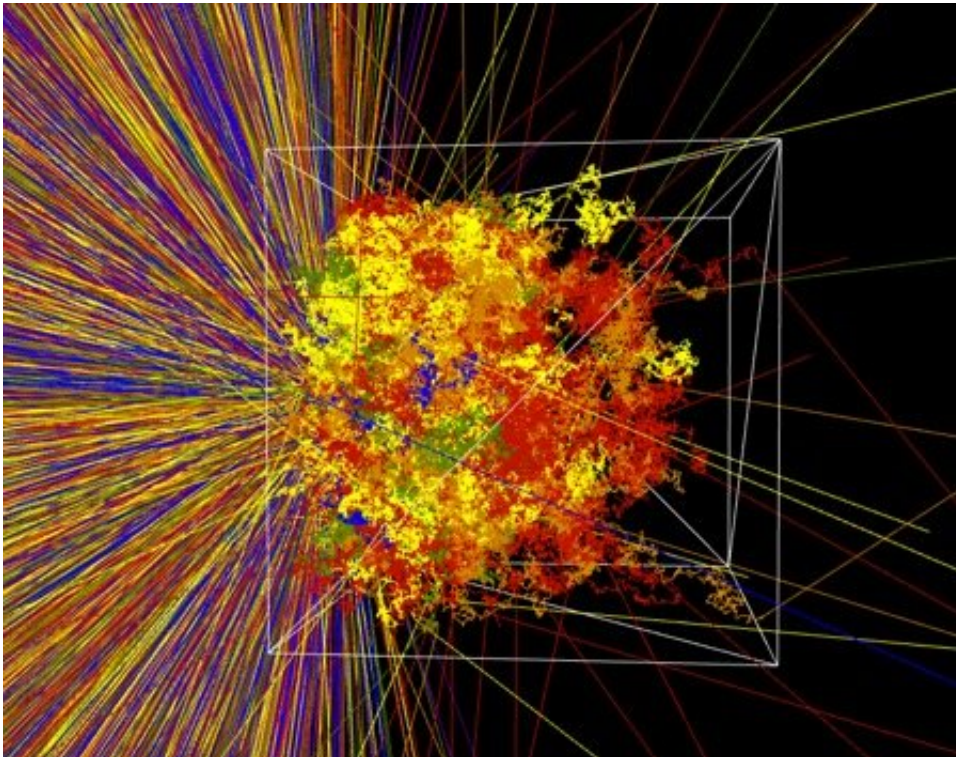
Simulations of near-infrared light (NIR) penetrating into skin tissue show that after 1 second of irradiation, a tumour (embedded 9 mm into skin tissue) infused with NIR absorbing gold nanoparticles, heats up by about 3 degrees Celsius, while after 10 minutes it has heated up by over 20 degrees Celsius. This is enough of a thermal dose to kill cancer cells. Credit: Charlie Jeynes

Working with biomedical scientist Nick Stone, also at Exeter, the team are refining computer models to better understand how detected light is affected by human tissue. They eventually expect to develop a rapid diagnostic test that avoids unnecessary biopsies, improving the prospects for survival for thousands of women. Work is already underway with clinicians at Exeter's RD&E hospital to pilot the technology and pave the way for larger clinical trials

In a second project, the Exeter team are using computer models for a potential new treatment for non-melanoma [skin cancer](#) (NMSC). This is the most common type of cancer, with more than 80,000 cases reported in England each year. NMSC is expected to cost the NHS £180 million a year by 2020, a figure set to rise as the disease becomes more prevalent.

In a partnership with Alison Curnow of the University of Exeter Medical School, the scientists are using their code to develop a simulated 'virtual laboratory' for studying skin cancer treatment. The two-pronged attack looks at light-activated drugs ([photodynamic therapy](#)) and light-heated nanoparticles (photothermal therapy).

The simulation looks at how gold nanoparticles in a virtual skin tumour are heated by exposure to near-infrared [light](#). After 1 second of irradiation, the tumour heats up by 3 degrees Celsius. After 10 minutes, the same tumour is heated by 20 degrees—enough to kill its cells. So far, photothermal therapy with nanoparticles has been effective in rats, but with the team's code to narrow down experimental conditions, they are working towards translating the technology for humans.



A computer model showing light following complex paths as it passes through tissue. Credit: Tim Harries

Charlie said: "Advances in fundamental science should never be seen in isolation. Astronomy is no exception, and though impossible to predict at the outset, its discoveries and techniques often benefit society. Our work is a great example of that, and I'm really proud that we're helping our medical colleagues wage war on [cancer](#)."

The next steps include using 3-D- rendered models taken from images of real tumours, and simulating how these would respond to different treatment regimes. Data exists on how these tumours responded to treatment, which gives excellent 'ground truth' data against which to compare the models. In this way the team will be able to predict whether different types of treatment would be more effective for a particular tumour type, and enable clinicians to have more options when it comes to choosing a treatment plan.

**More information:** [nam2019.org/](http://nam2019.org/)

Provided by Royal Astronomical Society

Citation: Astronomers help wage war on cancer (2019, July 2) retrieved 10 April 2024 from <https://phys.org/news/2019-07-astronomers-wage-war-cancer.html>

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