Stargazing led Alison Sills to a career in physics and astronomy

She will use new supercomputer to study why stars collide

BY ANDREW VOWLES

Even for a theoretical astrophysicist, it began with that simple but universal human impulse to look up, way up.

"Almost everyone likes to look at stars and think, 'Wow, what are they? Where did they come from?' We like the idea that the vast universe out there is somehow important to us," says Alison Sills, professor of physics & astronomy. Her leisure-time pursuits while growing up in Toronto included reading science fiction novels and astronomy books and gazing at the stars.

Today she spends less time looking at the night sky from her backyard and more time observing simulations of colliding stars on her desktop PC, using data fed from the Hubble Space Telescope and from fellow stargazers working at Earth-bound observatories in Chile and Hawaii.

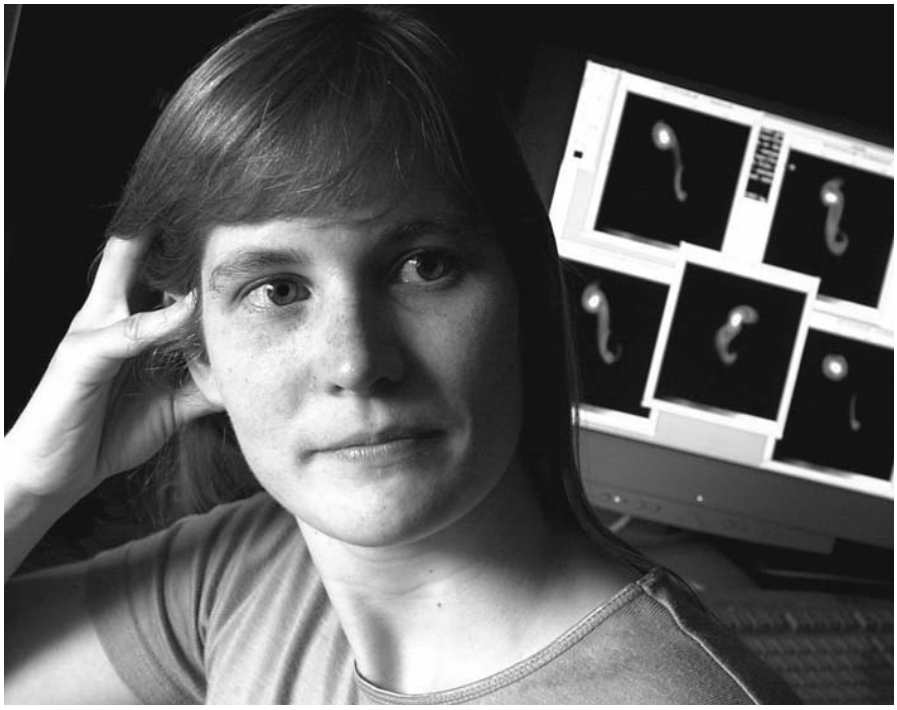
Last fall the Arthur Bourns Building became home to one of fastest supercomputers in the world dedicated solely to calculating gravitational forces between stars, particularly stars in the oldest parts of our galaxy. She's purchased the new desktop device through a New Opportunities grant worth almost $175,000 announced this past summer by the Canada Foundation for Innovation.

That was only the first piece of good news this year for Sills, who joined McMaster in 2001. In October 2002, she was named as the year's recipient of the Polanyi Prize for physics. (Four out of the year's five winners of the prestigious prize were McMaster researchers. Besides Sills, McMaster's complement of Polanyi Prize winners included Alex Adronov, chemistry; Thomas Crossley, economics; and Jeremy Yethon biochemistry.)

"I look at what happens when stars collide," Sills says. To do that, she studies stars not nearby in our Milky Way but packed in globular clusters out on the fringes of the galaxy. In these regions, groups of perhaps 100,000 stars carom around closely enough that they run into each other – a kind of stellar "demolition derby," according to the cover article of the November 2002 Scientific American, which mentioned work by Sills.

She says learning about what happens during and after these smash-ups can tell us more about the formation of the galaxy itself. Although the composition of stars varies from one cluster to the next, the stars within a cluster are similar in age and material. Equally important, they give us a glimpse back in time. "Globular clusters are the oldest pieces of the galaxy."

Trying to peg the age not just of the Milky Way but of the universe itself has led to collisions of opinion among professional stargazers, including arguments over the age of globular clusters themselves. About five years ago, some scientists calculated that these clusters were about 15 billion years old. That number was decidedly at odds with other astronomers' best guesses about the age of the entire universe at around 10 billion years old (for now, they've worked out a compromise of about 12-13 billion years).



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Sills' role in that debate involved looking at the workings of one particular cluster, where the frequency of collisions appeared to have slowed abruptly some two to three billion years ago.

She explains that dense star clusters are more likely to contain binary stars, or pairs of stars revolving around each other. Her simulations suggested that earlier collisions eventually used up the binary stars, lowering the odds of further smash-ups. Her work has been supported by that of other scientists studying formation of pulsars and the distribution of various kinds of stars in globular clusters.

"What fascinates me about astronomy is that we can learn a lot from almost nothing," says Sills. "You could understand these distant objects by knowing a bit of math and a bit of physics and looking at light."

"The truly amazing thing is that we get it right."

Only a relative handful of scientists worldwide study the dynamics of globular clusters and star collisions, and Sills is the only one in Canada. At McMaster, she's part of a cluster of seven astronomers studying aspects of the universe's formation and workings. "The astronomy and astrophysics group here is small but strong. Every single person is extremely creative and engaged in the national and international astronomy community."

Years ago, she had intended to pursue stellar evolution. Sills did her undergraduate degree at the University of Western Ontario, then went abroad – first to Yale University for her PhD. She did her post-doctoral research at Ohio State University and the University of Leicester. Along the way, she encountered a professor who awakened her interest in globular clusters. "He kept coming up with these bizarre stars and said someone's got to explain them. He was just so excited."