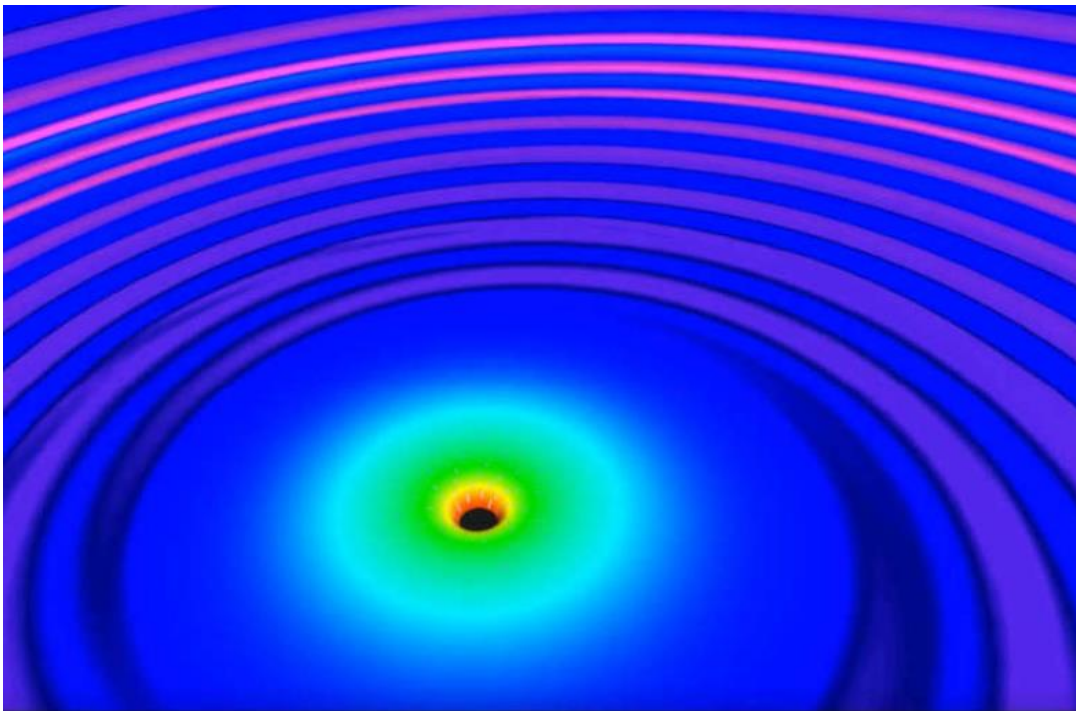


## Knit Kit 4: Wibbly Wobbly Timey Wimey



*Simulating eXtreme Spacetimes (SXS): Licensed under CC BY-NC 3.0*

An incredible, powerful crash wobbles space and time.

### **The Story**

Dr. Kate Macdonald

How the universe works is beyond amazing. A few years ago I was introduced to Prof Harald by a friend. Prof Harald sent me some images and videos about one of the most amazing bits of listening we humans have ever done. The team at LIGO (a huge gravitational wave detector) had 'heard' the ripples left over from the first 'chirp'. No idea what a chirp is? See Knit Kit 3. Prof Harald worked out how to program some huge computers so that they worked out the huge crash that made the chirp.

In this image, a snapshot of one of Prof Harald's videos, you can see the ripples as blue and pink. As they pass, they make spacetime stretch and bend, or as Doctor Who said, 'Wibbly wobbly timey wimey'. What's more, Prof Harald thinks that, throughout the universe, these huge crashes actually happen up to four times every hour - we just have to find their ripples!

Brilliant. Thanks LIGO team. Thanks Prof Harald.

### **The Science**

About a billion years ago, two black holes each about 30 times heavier than our sun fell into each other. First, these black holes circled each other hundreds of times, like cyclists in a speed trial at a velodrome, and then swoop into each other, all in less than a second. These huge forces warp time and space, like the wake of a speedboat. They leave ripples spreading out like waves on a still lake. By the time they reach us the ripples are very, very small. Even though they're quiet now, when they were made, the waves carried more power than all the light we can see in the universe. They travelled for over one billion years to reach us at Earth, luckily just as the LIGO detectors turned on for the first time. In September of 2015, the pair of detectors in America heard this wobble in space and time.

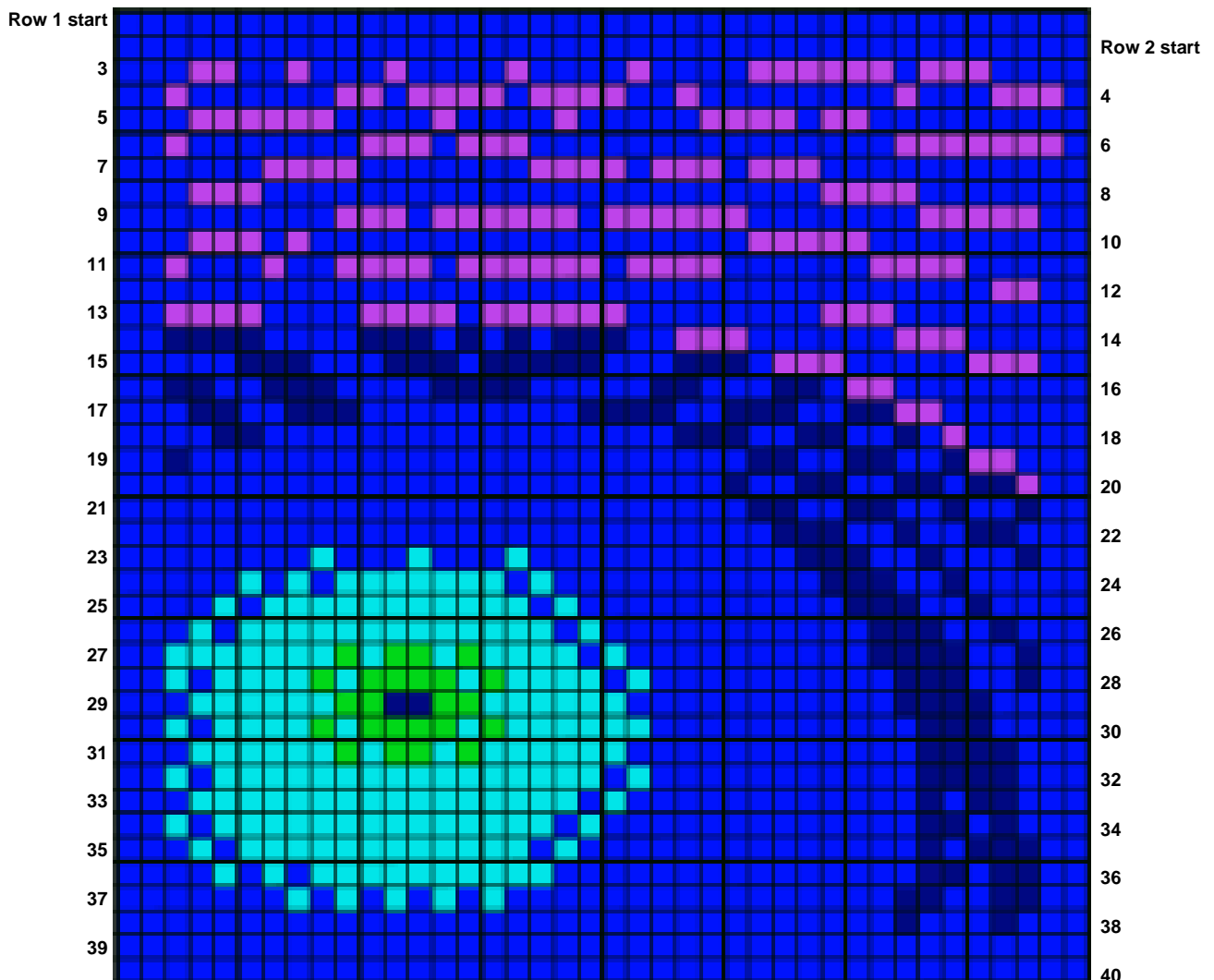
This is a complex knit. You will need:

- 5 colours of wool - we used dark blue, royal blue, cyan, green, and pink.
- A pair of knitting needles

And that's it!

Colours don't have to match the image, since the original image is recoloured. The scientists used a colour scheme that suited them, and so can you! So just use whatever you or your family have lying around. In this knit, we used around 25g of royal blue, and 10g each of all dark blue, cyan, green and pink, and 4mm knitting needles.

Skills used include: Cast On, Knit, Purl, Change Colour (fair isle), and Cast Off. Go to our website [www.knittheuniverse.co.uk](http://www.knittheuniverse.co.uk) for links to handy YouTube videos to learn these skills. Remember: After casting on, knit odd-numbered rows, changing colours as you go, and purl even numbered rows, changing colours as you go.



## Knitting Pattern

K – Knit      P– Purl      b – Royal blue   d – Dark blue      c – Cyan      g- Green      p – Pink

Brackets indicate stitches inside the brackets are repeated.

For example, P2b means purl 2 stitches in royal blue, and (K1c, K1b) twice means knit 1 stitch in cyan, 1 stitch in royal blue, and do this twice.

Cast on 40 stitches in royal blue (or an alternate colour).

Row 1-2: Knit one row, purl one row

Row 3: K3b, K2p, K2b, K1p, K3b, K1p, K4b, K1p, K4b, K1p, K4b, K6p, K1b, K3p, K4b

Row 4: P1b, P3p, P3b, P1p, P8b, P1p, P2b, P4p, P1b, P4p, P1p, P2p, P6b, P1p, P2b

Row 5: K3b, K6p, K4b, K1p, K4b, K1p, K5b, K4p, K1b, K2p, K9p

Row 6: P1b, P7p, P15b, P3p, P1b, P3p, P7b, P1p, P2b

Row 7: K6b, K4p, K7b, K4p, K1b, K3p, K1b, K3p, K11b

Row 8: P7b, P4p, P23b, P3p, P3b

Row 9: K9b, K3p, K1b, K6p, K1b, K6p, K7b, K5p, K2b

Row 10: P9b, P5p, P18b, P1p, P1b, P3p, P3b

Row 11: K2b, K1p, K3b, K1p, K2b, K4p, K1b, K6p, K1b, K4p, K6b, K4p, K5b

Row 12: P2b, P2p, P36b

Row 13: K2b, K4p, K4b, K4p, K1b, K6p, K8b, K3p, K8b

Row 14: P5b, P3p, P6b, P3p, P2b, P3d, (P1b, P1d) 3 times, P2d, P4b, P4d, P2b

Row 15: K5b, K3d, K3b, K3d, K1b, K5d, K3b, K3d, K1b, K3p, K5b, K3p, K2b

Row 16: P8b, P2p, P1b, P2d, P3b, P2d, P5b, P4d, P4b, P3d, P2b, P2d, P2b

Row 17: K3b, K2d, K2b, K3d, K9b, K4d, K2b, K3d, K2b, K2d, K2p, K6p

Row 18: P5b, P1p, P1b, P1d, P2b, P2d, P2b, P3d, P17b, P2d, P4b

Row 19: K2b, K1d, K23b, (K2d, K2b) twice, K1d, K2p, K3b

Row 20: P2b, P1p, P2d, P1b, (P2d, P2b) twice, P1d, P25b

Row 21: K26b, (K2d, K2b) twice, K1d, K2b, K1d, K2b

Row 22: P3b, P2d, P2b, P1d, P2b, P3d, P27b

Row 23: K8b, K1c, K3b, K1c, K3b, K1c, K11b, K3d, K2b, K1d, K3b, K1d, K2d

Row 24: P5b, P1d, P2b, P3d, P11b, P1c, P1b, P7c, (P1b, P1c) twice, P5b

Row 25: K4b, K1c, K1b, K11c, K1b, K1c, K11b, K3d, K2b, K1d, K4b

Row 26: P3b, P1d, P2b, P3d, P11b, P1c, P1b, P13c, P1b, P1c, P3b

Row 27: K2b, K7c, K1g, K1c, K2g, K1c, K1g, K4c, K1b, K1c, K10b, K4d, K2b, K1d, K2b

Row 28: P2b, P1d, P2b, P3d, P10b, P1c, P1b, P4c, P1g, P1c, P4g, P1c, P1g, P4c, P1b, P1c, P2b

Row 29: K3b, K6c, K2g, K2d, K2g, K6c, K11b, K4d, K4b

Row 30: P4b, P3d, P11b, P6c, P1g, P1c, P4g, P1c, P1g, P4c, P1b, P1c, P2b

Row 31: K3b, K6c, K1g, K1c, K2g, K1c, K1g, K6c, K12b, K4d, K3b

Row 32: P3b, P4d, P11b, P1c, P1b, P16c, P1b, P1c, P2b

Row 33: K3b, K16c, K1b, K1c, K12b, K1d, K1b, K2d, K3b

Row 34: P3b, P1d, P1b, P2d, P13b, P1c, P1b, P14c, P1b, P1c, P2b

Row 35: K3b, K1c, K1b, K12c, K1b, K1c, K14b, K1d, K1b, K3d, K2b

Row 36: P2b, P2d, P1b, P2d, P15b, P10c, (P1b, P1c) twice, P4b

Row 37: K7b, (K1c, K1b) 4 times, K1c, K16b, (K2d, K2b) twice

Row 38: P3b, P1d, P3b, P1d, P32b

Row 39-40: Using blue, knit one row, purl one row

Cast off.