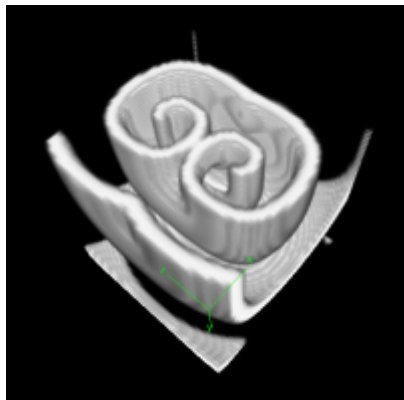


# Reaction-diffusion models

## 3D reaction-diffusion: Excitable Media



Scroll wave appear in Barkley model of excitable media in 3D



### Introduction

This example uses the [Barkley model of excitable media](#), similar to the [Fitzhugh-Nagumo model](#) to show how to model and visualize reaction-diffusion models in 3D.

### Model description

This model defines a 3D cubic Lattice with `noflux` BoundaryConditions. Two Layers are defined for the two species: 'u' is the signal, and 'v' the refractoriness. As in the examples above, the DiffEqn as specified in the System in PDE. Nothing strange here.

To visualize the resulting scrolling waves in 3D, the TiffPlotter is used. This Analysis plugin writes TIFF image stacks that can be opened by image analysis software such as [Fiji/ImageJ](#). To import Morpheus TIFF images into Fiji, macros scripts are available that help you to create 3D (xyz), 4D (xyzt) or even 5D (xyzct) images and movies of your simulations.

Although unable to plot 3D, the GnuPlotter can still be helpful to plot a 2D slice. See [Analysis/Gnuplotter/PDE/slice](#).

### Model

h ExcitableMedium\_3D.xml |h

```
extern>http://imc.zih.tu-dresden.de/morpheus/examples/PDE/ExcitableMedium_3D.xml
```

In Morpheus GUI: Examples → PDE → ExcitableMedium\_3D.xml

### Things to try

- Import resulting sequence of TIFF images in ImageJ or Fiji, and create 4D movie using ImageJ's 3D plugin:
  1. Open `u_v.tif` in ImageJ: File → Open.
  2. Create hyperstack: Image → Hyperstack → Convert to Hyperstack. Channels (c): 2, Slices (z): 50, Frames (t): 51, Display Mode: Composite.
  3. Display in 4D: Plugins → 3D Viewer. Use default parameters. Press OK.

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