

Bifröst Physics

User's Guide



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You can find the latest official version of Bifröst Physics at <http://www.pcs.cnu.edu/~afrazier/bifrost> free of charge.

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What is Bifröst Physics?



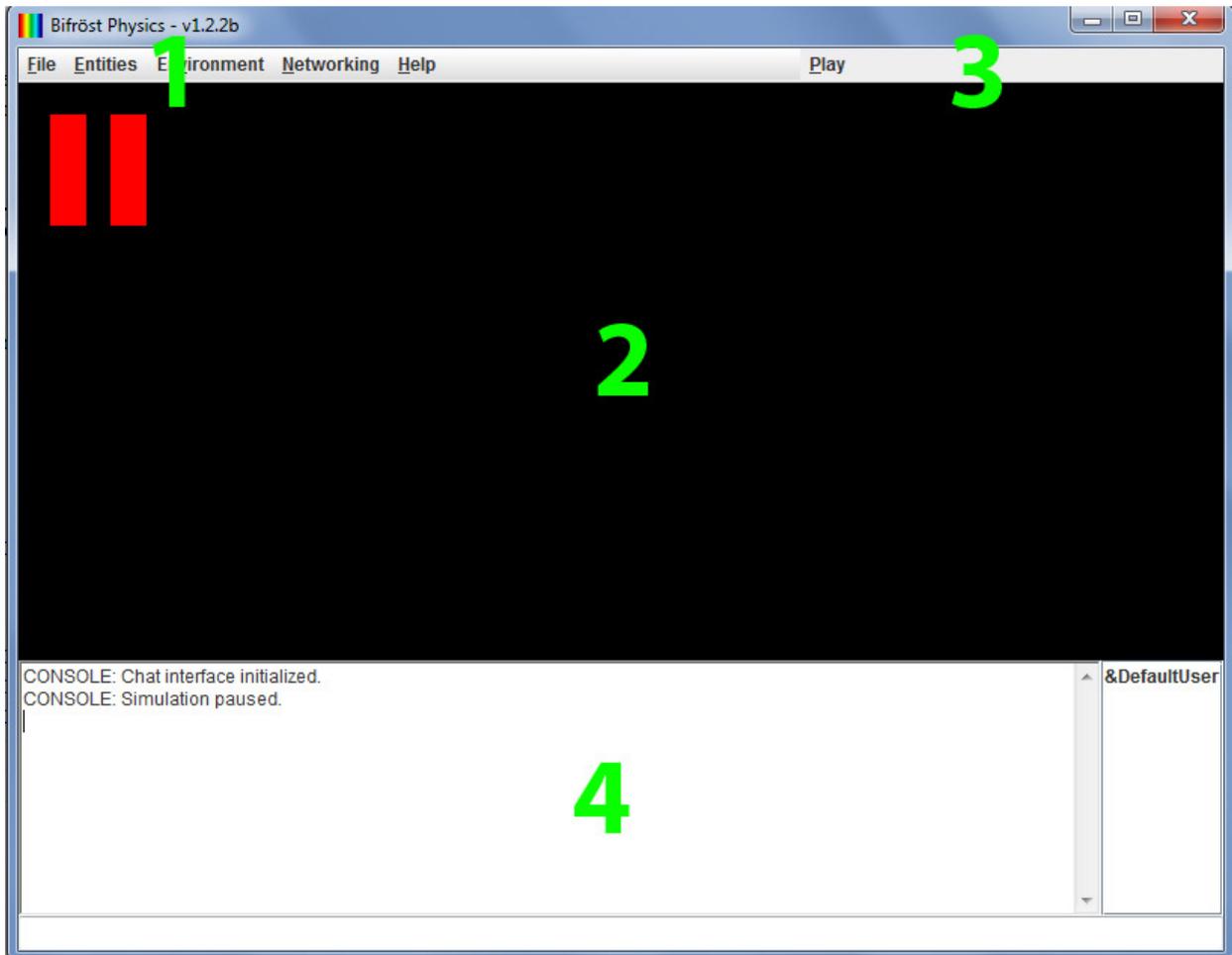
In Norse mythology, Bifröst is a flaming bridge of rainbows which facilitates travel between Asgard, the realm of the Gods; and Midgard, land of the Mortals. Bifröst Physics is a 2D physics simulator and teleteaching tool which seeks to help bridge the gap between students and teachers by providing a platform for students to experiment with and replicate examples designed by their teachers. For example, a teacher may construct a Bifröst Physics environment containing a star with an orbiting planet. The student could then tinker with the masses of the two objects, or even attempt to get a moon to orbit the planet.

Bifröst Physics also provides a platform for teleteaching through the internet or local networks. A teacher or tutor can host a class, and other students can connect and participate in the teacher's experiment.

Getting Started

Getting started with Bifröst is easy. Simply download the executable jar onto your local machine and launch it by double clicking on it. You will need a JRE installed to run the software.

The Interface



Section 1 - Main Menu

File

- New* – Creates a new experiment
- Open* – Opens a previously saved experiment
- Save* – Saves the current experiment
- Exit* – Exits the program

Entities

- Add* – Opens the dialog to create an entity
- Edit* – Opens a list of all currently existing entities

Entities (cont.)

Generator

Random – Generates a specified amount of random entities

Random (Scaled) – Generates entities which scale to their mass

Row – Generates entities in a row

Column – Generates entities in a column

Lattice (Square) – Generates entities to fill a specified region

Toggle All

Trace – Toggles trace on/off for all entities

Draw Velocity Vectors – Toggles velocity vectors for all entities

Party Mode

Fine Circles – If enabled, will draw precise borders for entities

Environment

Edit – Allows you to edit the environment specifications

Reset – Resets the environment settings to the default values

Networking

Connect – Attempts to connect to a specified server

Host – Hosts a server

Push Physics Data – (Host only) Pushes current state to all clients

Disconnect – Disconnects the current network session

Help

About – Shows some information about the program

Section 2 – The Viewport

This is where you view the simulation and perform mouse commands (*See Mouse and Keyboard Commands*)

Section 3 – The Play/Pause Button

This button controls whether or not the simulation is running

Section 4 – The Chat Panel

This is where you view console output, chat from other users, and input chat transmissions or chat commands of your own

The Dialogs

The Entity Editor (Figure 1)

The entity dialog allows for a user to edit/create entities based upon specified parameters. Co-ordinates are specified with the bottom-left hand corner of the viewport being (0,0). Pinned makes the entity immovable; Collidable makes the entity interact with other collidable objects; Trace draws the trajectory of the entity behind it; Draw velocity draws the velocity vector originating from the center of the entity. Entity names help identify the entity in the editing list.

NOTE: When creating a new entity, it cannot have the same co-ordinates as another entity. This will result in an error. If you need two entities to have similar co-ordinates, place one slightly to the left ($\sim e-6$)

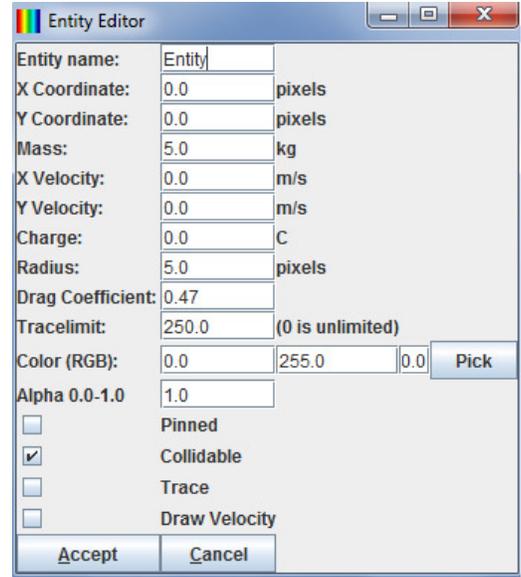


Figure 1 The Entity Editor

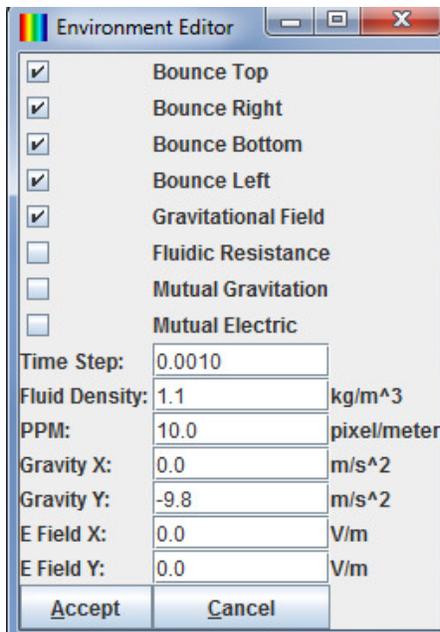


Figure 2 The Environment Editor

The Environment Editor (Figure 2)

The environment dialog allows you to alter the way your environment affects your entities. The bounce flags indicate whether an entity should bounce off of that specified border. Gravitational field indicates whether entities should be subject to the specified Gravity X/Y field. Fluidic resistance (aka Air resistance) can be enabled to simulate real-life air resistance or you can alter the Fluid Density parameter to simulate a fluid. Mutual gravitation toggles the ability of entities to attract other entities gravitationally. Mutual electric toggles the ability of entities to attract or repel one another due to their charges. Entities are always affected by any specified E field.

The time step variable controls how many simulated seconds pass with each simulation iteration. The internal simulator does the processing of each environment in one millisecond chunks, thus, when this number is set to .001, it attempts to simulate in real time. If it were set to 5, it would attempt to simulate 5 seconds for every one millisecond that passes in real time. However, when the number of entities in the environment exceeds what the host computer can process reasonably, slowdowns can occur. PPM sets how many on screen pixels it takes to constitute a meter of simulate space.

NOTE: Time stamps greater than .005 can result in simulation quality degradation

Mouse and Keyboard Commands



Mouse Commands

*Double Left Click** – In empty space, bring up the add entity dialog, with its location at the click location. On an entity, bring up the entity editor with that entity loaded

*Left Click, then Drag** – On an entity, moves that entity

Right Click – On an entity, brings up the entity inspector

Hold ALT; Left Click, then Drag – Measure the simulated space distance between points

*Hold CTRL; Left Click, then Drag** – Define a square region for lattice generation

*Hold CTRL+ALT; Left Click, then Drag** - Define a line for entity generation

Keyboard Commands

*Quick Save** – **F5** – Save the current environment to the quick save file
(**CAUTION:** this will be lost if you close the program)

*Quick Load** - **F7** – Load the quick save file

*Push Physics Data** - **F2** – Push physics data to clients

Play/Pause – **CTRL + Space** - Play or pause the simulation

Chat Commands

/disconnect – Disconnect from the current network session

/connect user@ip:port – Attempts to connect to a network session

/host user@port – Attempts to host a network session

Command Line Arguments

Typically, you won't need these, however, for documentation's sake they are included here.

-p [X] – Processor emulation. X is an integer. Simulates running on a machine with the specified amount of processors.

* - Usable only when hosting a network session and paused.

* - Usable only when paused