

# Dieluohan Big Bang Theorem

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## *Abstract*

*Dieluohan can replicate in all directions indefinitely like a Big Bang. This is a universal phenomenon.*

## **Introduction**

Dieluohan is a multiple overlap of Sudokus<sup>1,2</sup>. It has been found that Dieluohan is capable of replicating itself indefinitely like the big bang of the universe, albeit in two-dimensions.

## **The Propagation of Plum Sudoku**

It was first noticed that Dieluohan can expand indefinitely, and the infinite replication process involves only a small unit, a single Sudoku<sup>1</sup>. That Sudoku is from the Plum Sudoku<sup>1</sup> family.

Plum Sudoku has three rules: digits on every row, on every column, and on the same coordinate position of every 3X3-grid must be unique. There are other Sudoku variants that also possess these characteristics, e.g., Rainbow Sudoku<sup>2</sup> and Rainbow Web Sudoku<sup>2</sup>. Any Sudoku that obeys the rules of Plum Sudoku is a member of the Plum Sudoku family. We found that all members of the Plum Sudoku family possess the ability to generate new Plum Sudokus line by line.

Let us take Table 1 as an example. This Dieluohan is a 15X15 square-shaped, 35-degree, non-homogeneous Dieluohan. It was previously identified as a nine-degree homogenous Rainbow Web Dieluohan before Plum Sudoku was discovered<sup>2</sup>. In this Dieluohan, there are a total of 9 Rainbow Web Sudokus and 26 Plum Sudokus imbedded within. All Sudokus share the core grid, G7~I9 (marked in blue). The core grid has a maximum number of 35 Sudoku-overlaps, hence the 35 degrees. If we randomly choose any one of the Plum Sudokus on the edges of the Dieluohan as a starting point for expansion, then we are able to replicate and increase the Dieluohan size in all directions line by line.

Let us focus on the horizontal direction of a Plum Sudoku G1~O9 (a Rainbow Web Sudoku). The top row is “ghiabcdef” (G1~O1), if we added a digit “g” to the right we create a ten digits line “ghiabcdefg”. The nine digits on the right hand side are all unique, which satisfies the Sudoku rule to be a row for any Sudoku. Similarly, the other eight rows produce “efhgibcad”, “cafdeghib”, “fdcabhige”, “abgihefdc”, “igefdcabh”, “ghbcafdei”, “deihgabcf”, and “bcdefigha”. All of the new 9-digit lines produced satisfy the condition to be a row for a new Sudoku. When they all line up from top to bottom, voila, we have a new Plum Sudoku! In every row the digits are unique; in every column the digits are unique; and in every 3X3-grid unique digits occupy the same coordinate positions. When this process is repeated nine times, a duplicate of the original Sudoku appears right next to the original.

### **The Propagation of Classic Sudoku**

Generation of new rows or columns seems natural for all types of Sudoku. But few of them can propagate line by line if their intrinsic rules also must be applied, such as: digits in each cell of 3X3-grid must also be unique. Only Plum Sudoku can fulfill this requirement to create a Sudoku of its own kind. The unique digit restriction on the positions of all nine 3X3-grids, is the reason why line by line propagation can be made possible. Rainbow Sudoku and Rainbow Web Sudoku, however, can also generate a new Sudoku of its own kind, but in every third step. They can generate Plum Sudokus in each of their first two steps. This pattern can be repeated.

When we tried other types of Sudokus, we found Sudokus that obey Classic Sudoku rules can also generate super large Dieluohans. Dieluohan can be expanded by adding a 9X3 grid one at a time. A newly generated Sudoku is actually a permutation of the original Sudoku by exchanging two 9X3-grid columns or rows simultaneously twice. Among them, more restricted Sudokus from the Classic Sudoku family, such as Web Sudoku<sup>3</sup> or Rectangle Outline Sudoku<sup>3</sup>, show a regular pattern in that they first generate two Classic Sudokus before generating twin Sudokus on every third step.

### **Dieluohan Big Bang Theorem**

The conclusion and the Dieluohan Big Bang Theorem are thus very obvious: “Dieluohan can replicate in all directions indefinitely like a Big Bang”

Table 1<sup>2</sup>. This is a 15X15 35-degree, non-homogeneous, square Dieluohan. It contains 9 Rainbow Web Sudokus and 26 Plum Sudokus. The first-cell locations for Rainbow Web Sudokus are A1, A4, A7, D1, D4, D7, G1, G4, and G7. First cells for Plum Sudoku are evenly distributed along column A and columns D to G. In this table, the coordinates follow spreadsheet convention. Numerals represent the row number, and uppercased alphabets represent the column number. Lowercased alphabets represent any numerical number from 1 to 9 contained in a Sudoku puzzle.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	a	b	c	d	e	f	g	h	i	a	b	c	d	e	f
2	i	g	h	b	c	a	d	e	f	h	g	i	b	c	a
3	f	d	e	g	h	i	b	c	a	f	d	e	g	h	i
4	c	a	b	h	i	g	e	f	d	c	a	b	h	i	g
5	h	i	g	e	f	d	c	a	b	g	i	h	e	f	d
6	e	f	d	c	a	b	h	i	g	e	f	d	c	a	b
7	b	c	a	f	d	e	<b>i</b>	<b>g</b>	<b>h</b>	b	c	a	f	d	e
8	g	h	i	a	b	c	<b>f</b>	<b>d</b>	<b>e</b>	i	h	g	a	b	c
9	d	e	f	i	g	h	<b>a</b>	<b>b</b>	<b>c</b>	d	e	f	i	g	h
10	a	b	c	d	e	f	g	h	i	a	b	c	d	e	f
11	i	g	h	b	c	a	d	e	f	h	g	i	b	c	a
12	f	d	e	g	h	i	b	c	a	f	d	e	g	h	i
13	c	a	b	h	i	g	e	f	d	c	a	b	h	i	g
14	h	i	g	e	f	d	c	a	b	g	i	h	e	f	d
15	e	f	d	c	a	b	h	i	g	e	f	d	c	a	b

## Reference

1. Jau-Min S. Guo, "Dieluohan, a New Frontier for Multiple Sudoku Overlaps", <http://mysite.verizon.net/res7seqq/id15.html> (November 12, 2006).
2. Jau-Min S. Guo, "Dieluohan, the Superimposition of Multiple 9X9 Sudokus", <http://mysite.verizon.net/res7seqq/id15.html> (October 9, 2006).
3. <http://www.chinasudoku.com>.