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Proposal of experimental realization
of 3D Anderson transition with kicked cold atoms
by D.L.Shepelyansky
(2 letters to J.C.Garreau at 29 July  and 3 Oct 2005).

****************************************************************
Email 1
-----Message d'origine-----
De : dima [mailto:dima@irsamc.ups-tlse.fr]
Envoye: vendredi 29 juillet 2005 13:39
A : Jean-Claude Garreau
Objet : Re: Preprint

Dear Professor Garreau,

thank for the preprint of your nice exprement.

I would like to ask the following:
you have now about 100kicks
and it seems to me that with your equipment
it is possible to see experimentally
3d Anderson transition with cold atoms
for the first time
(I tried to convince Raizen to do this
in 1994 but his claim was that he has not enough kicks).

To have this transition
you should replace
[1-eps*cos(omega*t)]
by
[1-eps*cos(omega*t)*cos(omega1*t)]
and take omega/2pi and omega1/2pi
as two irrational numbers.
Numerical data of Ref.1 (pdf attached)
shows that the Anderson transition
takes place around K/hbar = 1.8
for eps=0.75 (see Fig.1 there).

This 3d Anderson transition
had been also discussed in Refs.2-4.
(pdfs are available from my publication list
on my web page).

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I will be glad to give more information.

With best regards,
Dima Shepelyansky
http://www.lpt.irsamc.ups-tlse.fr/~dima
Refs:

Ref.1
76. F.Borgonovi, D.L.Shepelyansky, "Two interacting particles in an effective 2-3-d random potential", J. de Physique I France v.6 (1996) p.287-299 (cond-mat/9507107)

Ref.2
37. G.Casati, I.Guarneri, D.L.Shepelyansky, "Anderson Transition in a One-Dimensional System with Three Incommensurate Frequencies", Phys. Rev. Lett. v.62, p.345-348 (1989)

Ref.3
86. F.Borgonovi and D.L.Shepelyansky, "Particle propagation in a random and quasi-periodic potential", Physica D, v.109 (1997) p.24-31 (cond-mat/9610137)

Ref.4
141. A.A.Pomeransky and D.L.Shepelyansky, ``Quantum computation of the Anderson transition in the presence of imperfections'', Phys. Rev. A v.69 (2004) p.014302 (quant-ph/0306203)
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--:**-  dlslets.txt    29% L56    (Text)----------------------------------------

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Email 2
Date: Mon, 3 Oct 2005 21:06:49 +0200 (CEST)
From: dima <dima@irsamc.ups-tlse.fr>
To: Jean-Claude Garreau <jean-claude.garreau@univ-lille1.fr>
Subject: Re: RE : RE : Preprint
Parts/Attachments:

| | | | |
|---|---|---|---|
| 1 | Shown | 46 lines | Text |
| 2 | OK | 39 KB | Application, "diff.ps" |
| 3 | OK | 46 KB | Application, "prob.ps" |
| 4 | OK | 42 KB | Application, "prob0.ps" |

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Bonjour Jean-Claude,

attached are figs is postscript
for kicked rotator at k=1; 1.5; 2.0; 2.2
and hbar (or h)=2; thus chaos parameter
is K=k hbar that corresponds to chaotic regime.

Fig diff.ps shows second moment of
distribution during 200 kicks.
It clearly shows that k=1; 1.5 are
localized while k=2.0 is delocalised so
thus the Anderson transition
is somewhere in between.

Fig prob.ps shows decimal log
of level probability Wp vs level number
for the value of k given above
(the change from parabolic
to linear cusp shap also shows
the transition aroun 1.8).

fig prob0.ps
shows probability P0 at initial zero n=0 state
as a function of time for the cases of fig diff.ps.
Here fluctuation are to strong to see the existence
of transition. Even if in experiment you will
have very good averaging over many
quasi-momentum states I doubt that
P0 is a good characteristic,
indeed in 1d diffusion
the probability at zero drops as 1/sqrt(t)
that is too slow for a given time interval.

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I think the only way to detect the transition
is to measure Wp as it had been done by Raisen.
You may show Wp at different moments of time
showing frozen and diffusive spreading.

in cases above the kick amplitude is
k(t)=k(1+0.75*coswt*cos(w1*t))
with w=2\pi/1.3247; w1=w/1.3247.
runs are for quasimomentum=0

best regards,
Dima

======NOTE=======>these figs are at the end of file in this order:

    [ Part 2, "diff.ps"  Application/POSTSCRIPT  52KB. ]        ==>4 pages
    [ Not Shown. Use the "V" command to view or save this part. ]


    [ Part 3, "prob.ps"  Application/POSTSCRIPT  62KB. ]        ==> next 4 pages
    [ Not Shown. Use the "V" command to view or save this part. ]


    [ Part 4, "prob0.ps"  Application/POSTSCRIPT  57KB. ]       ==> next 4 pages
    [ Not Shown. Use the "V" command to view or save this part. ]
**********************************************************************
figs files are given below:
diff.pdf (4 pages); prob.pdf (4 pages); prob0.pdf (4 pages)
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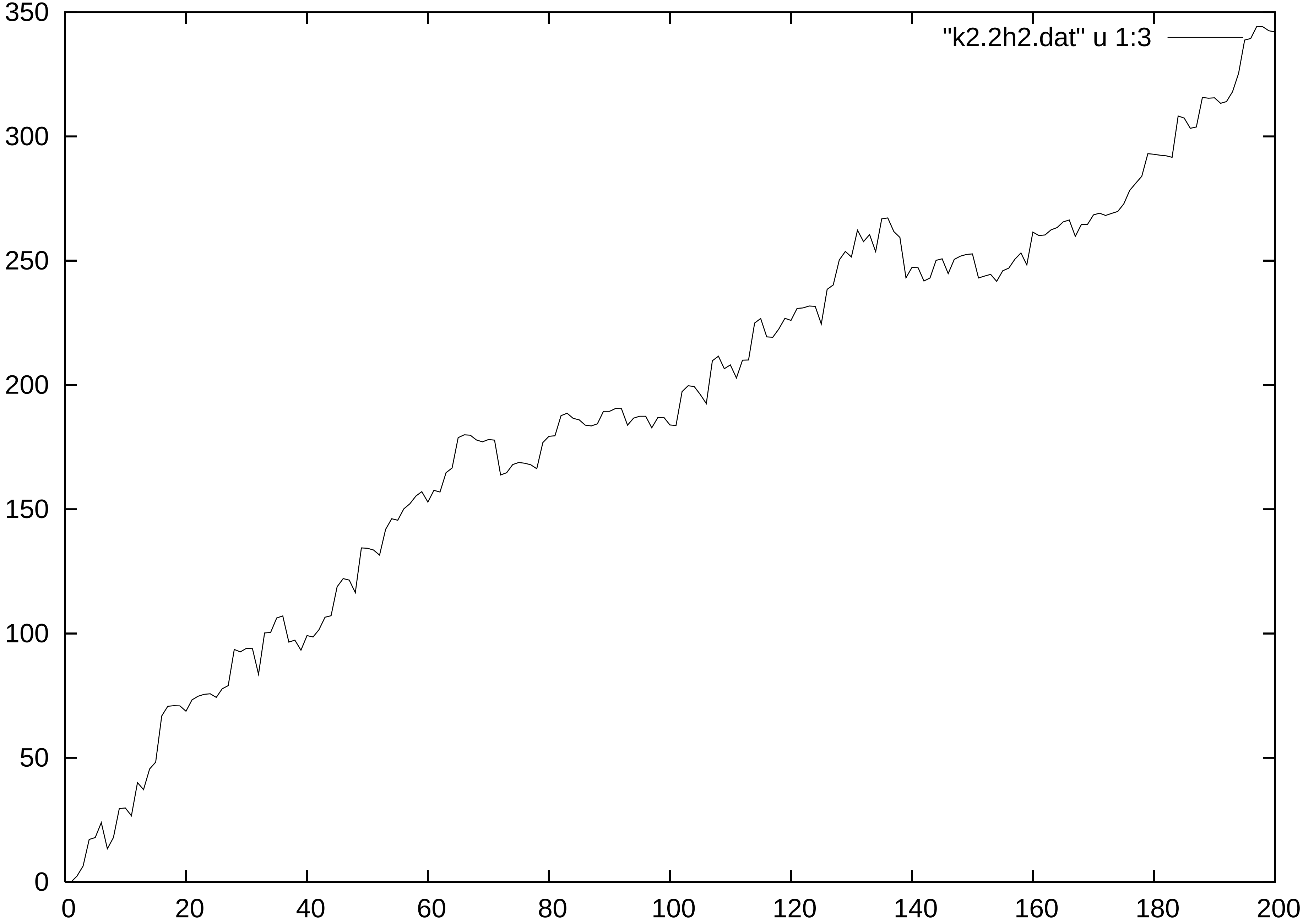

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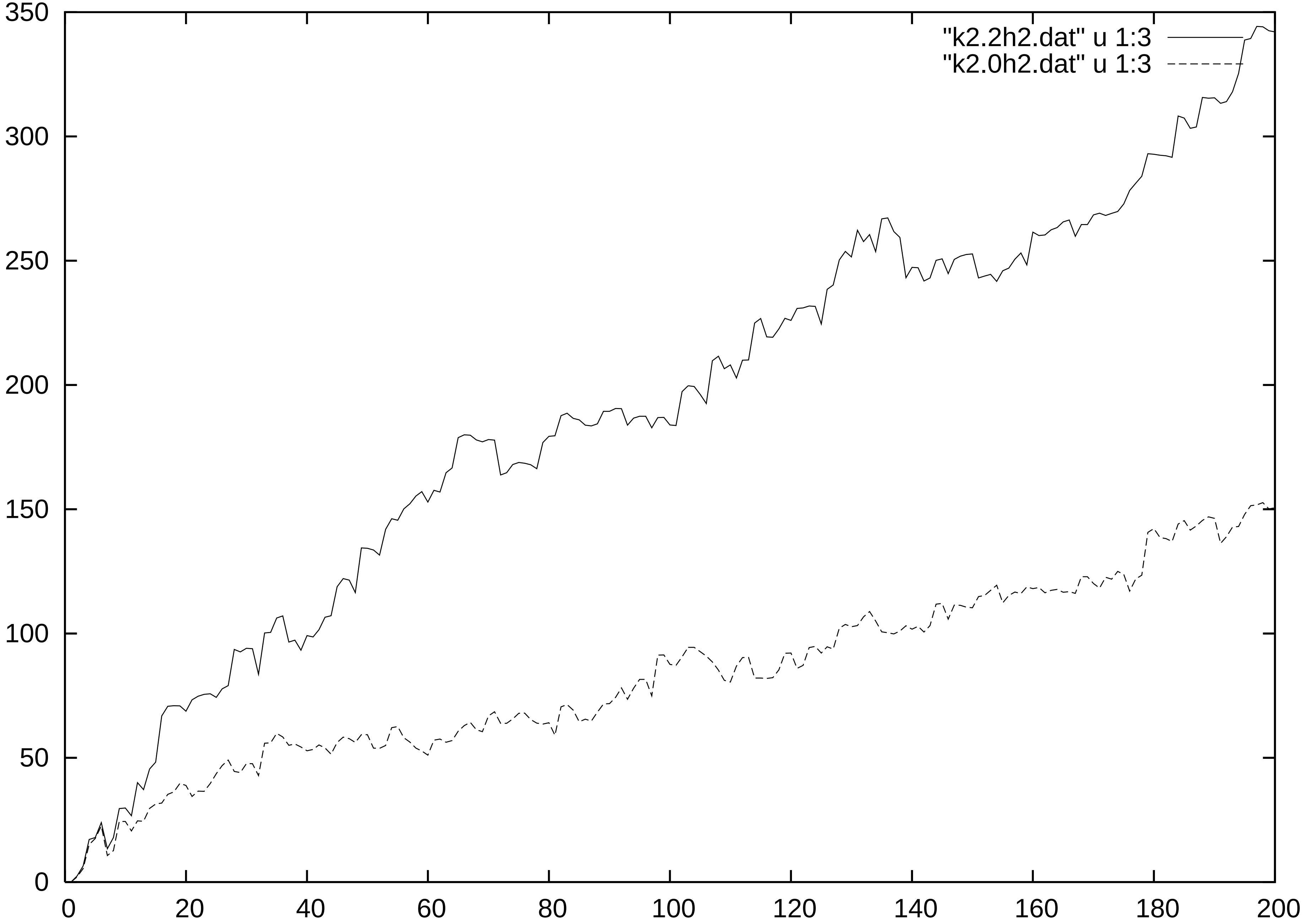

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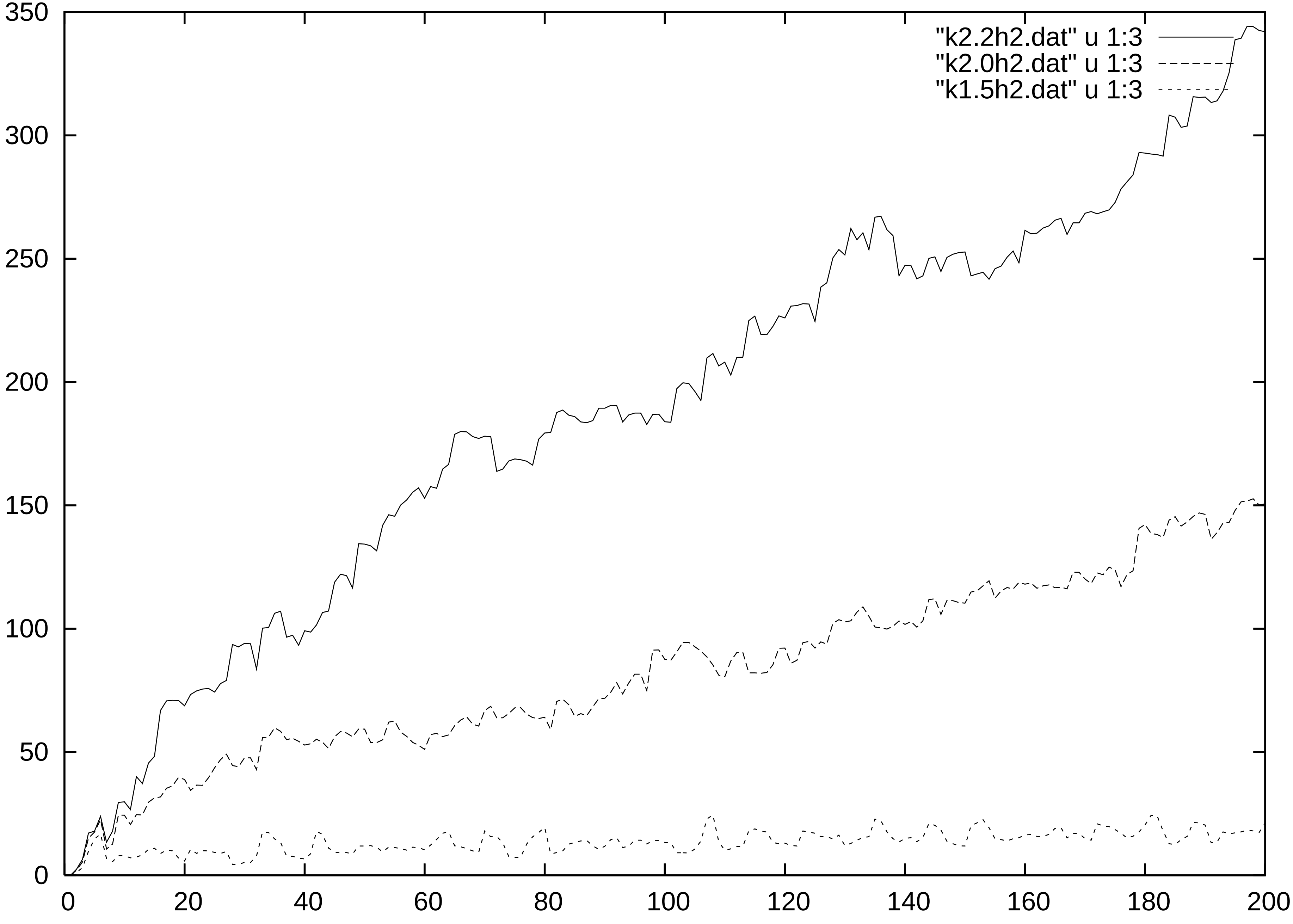

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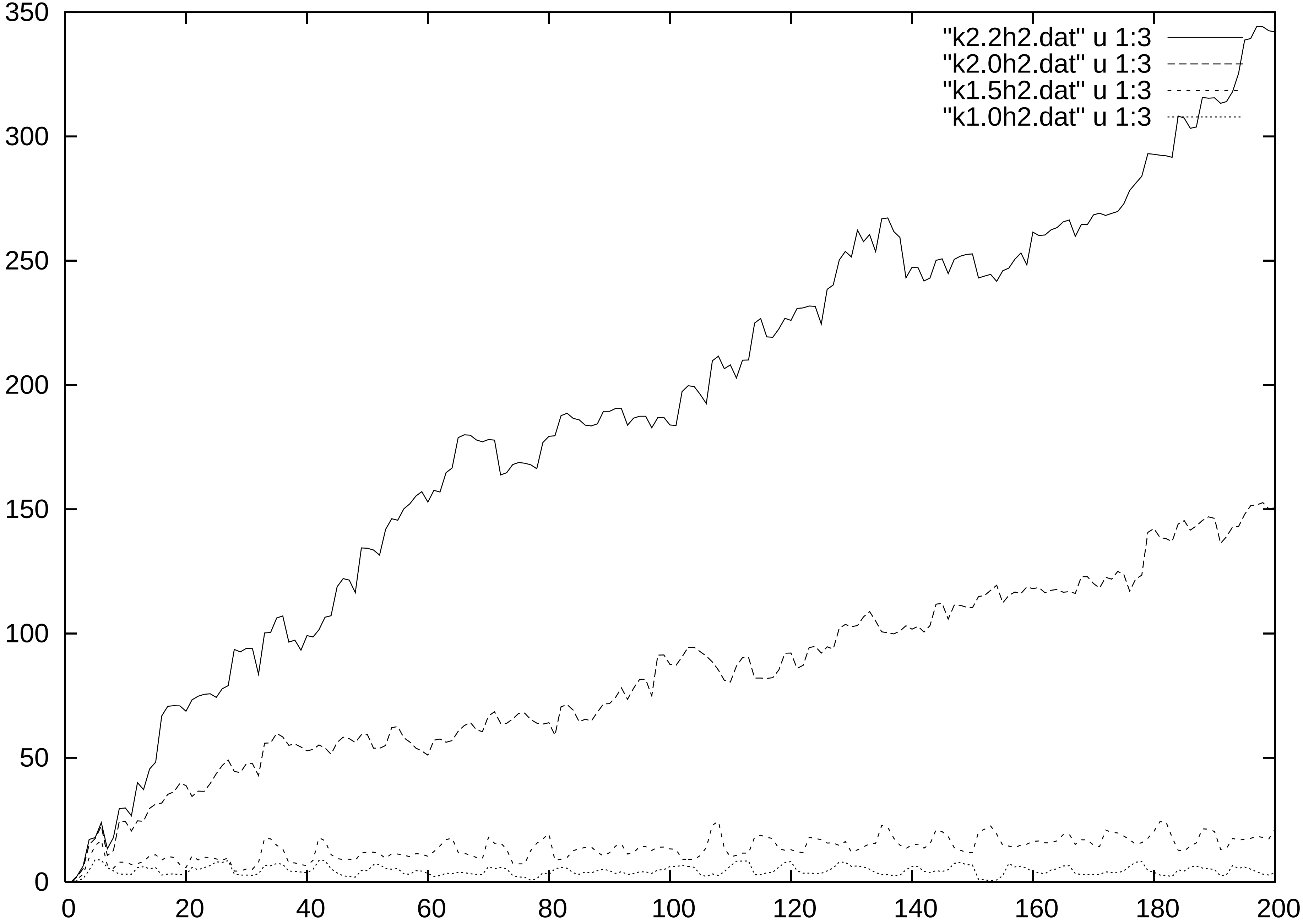

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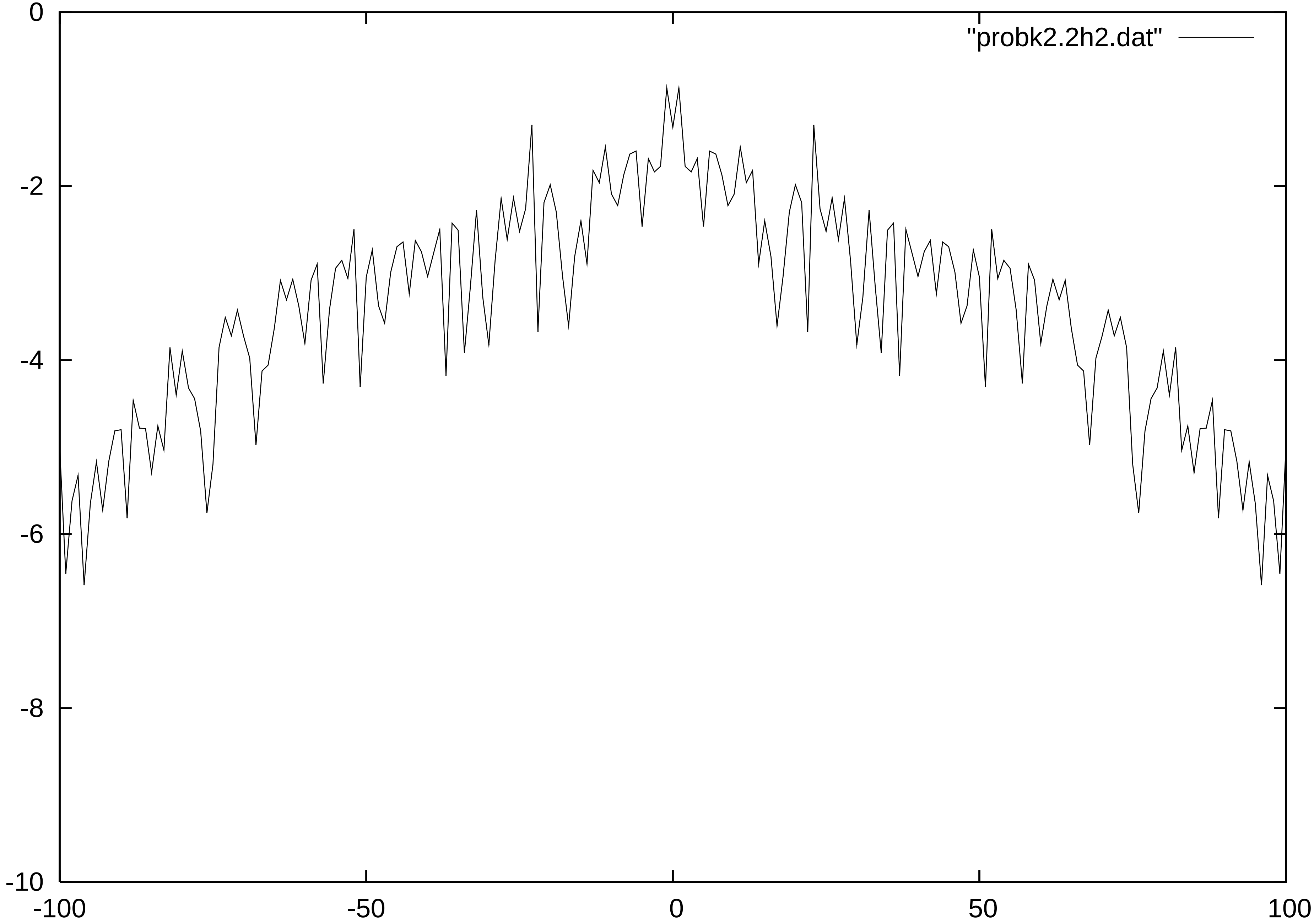

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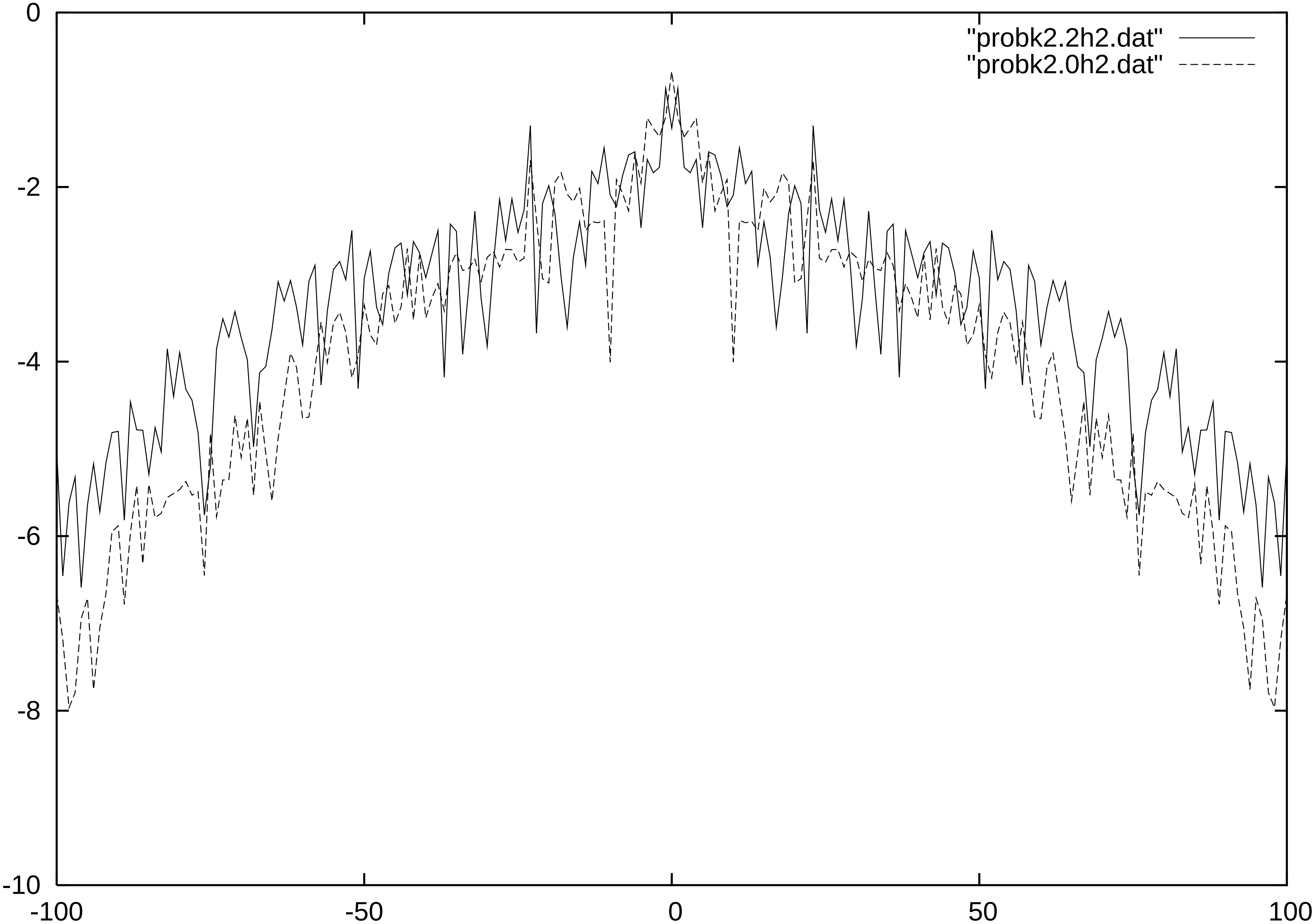
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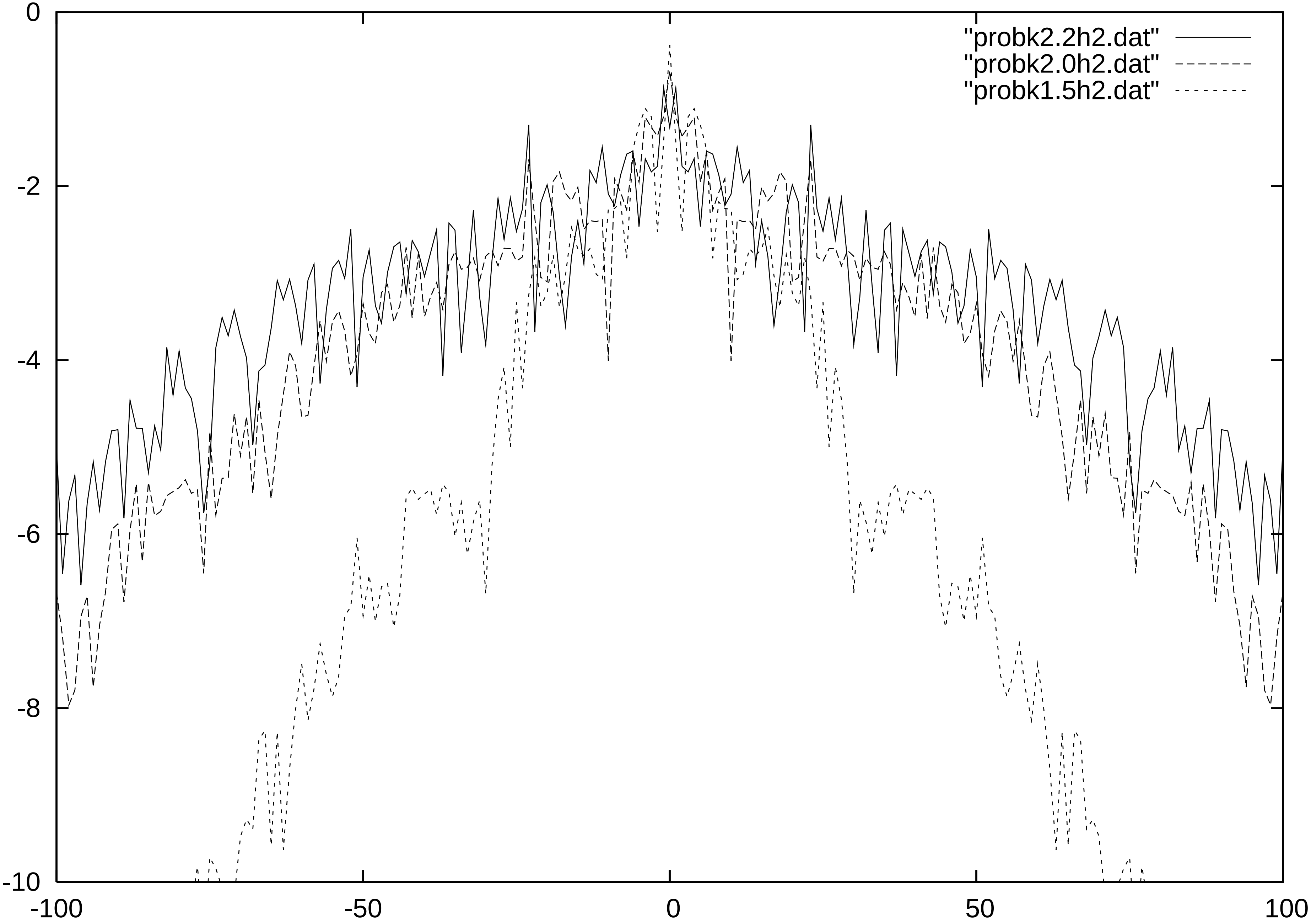
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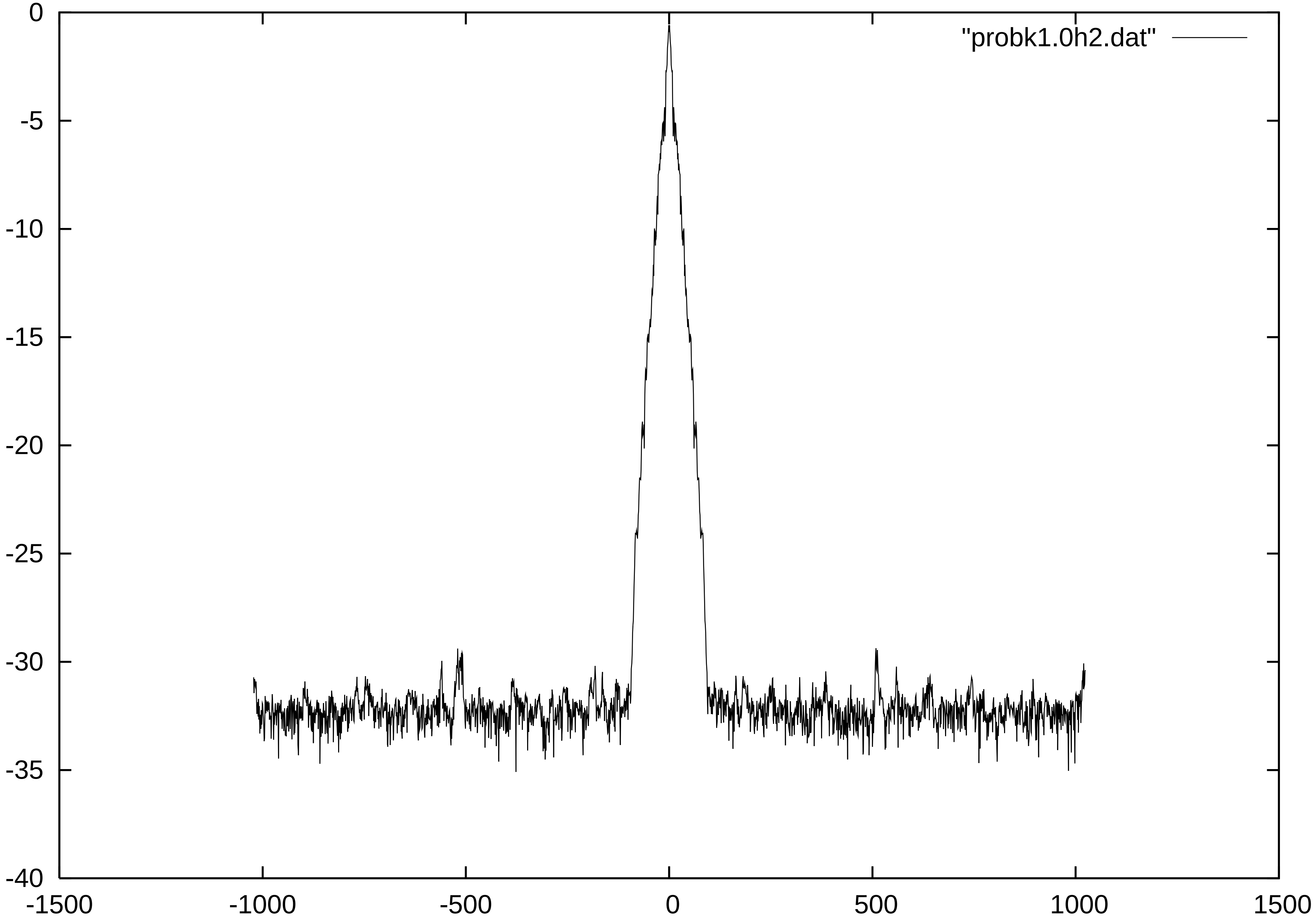
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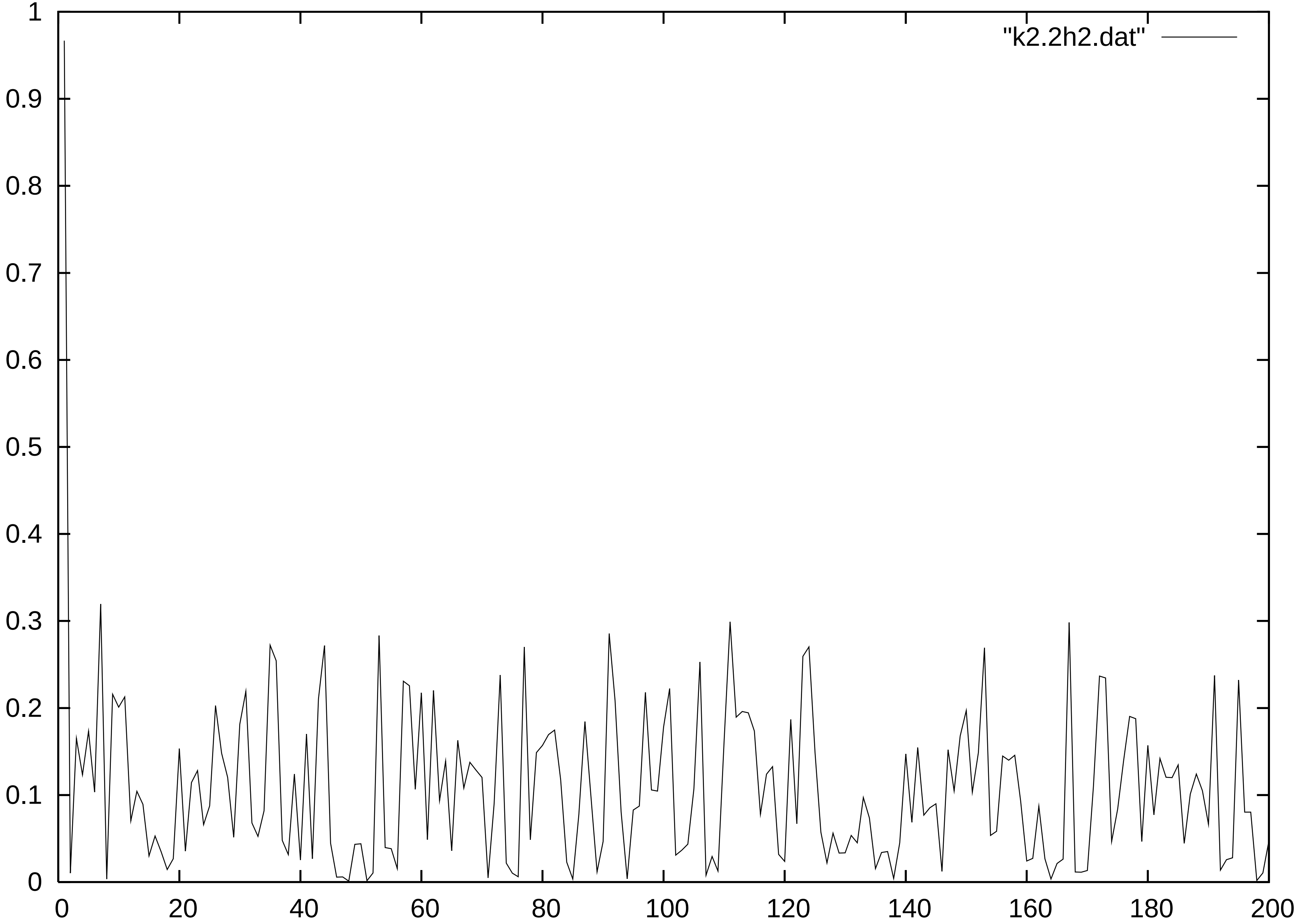
1500



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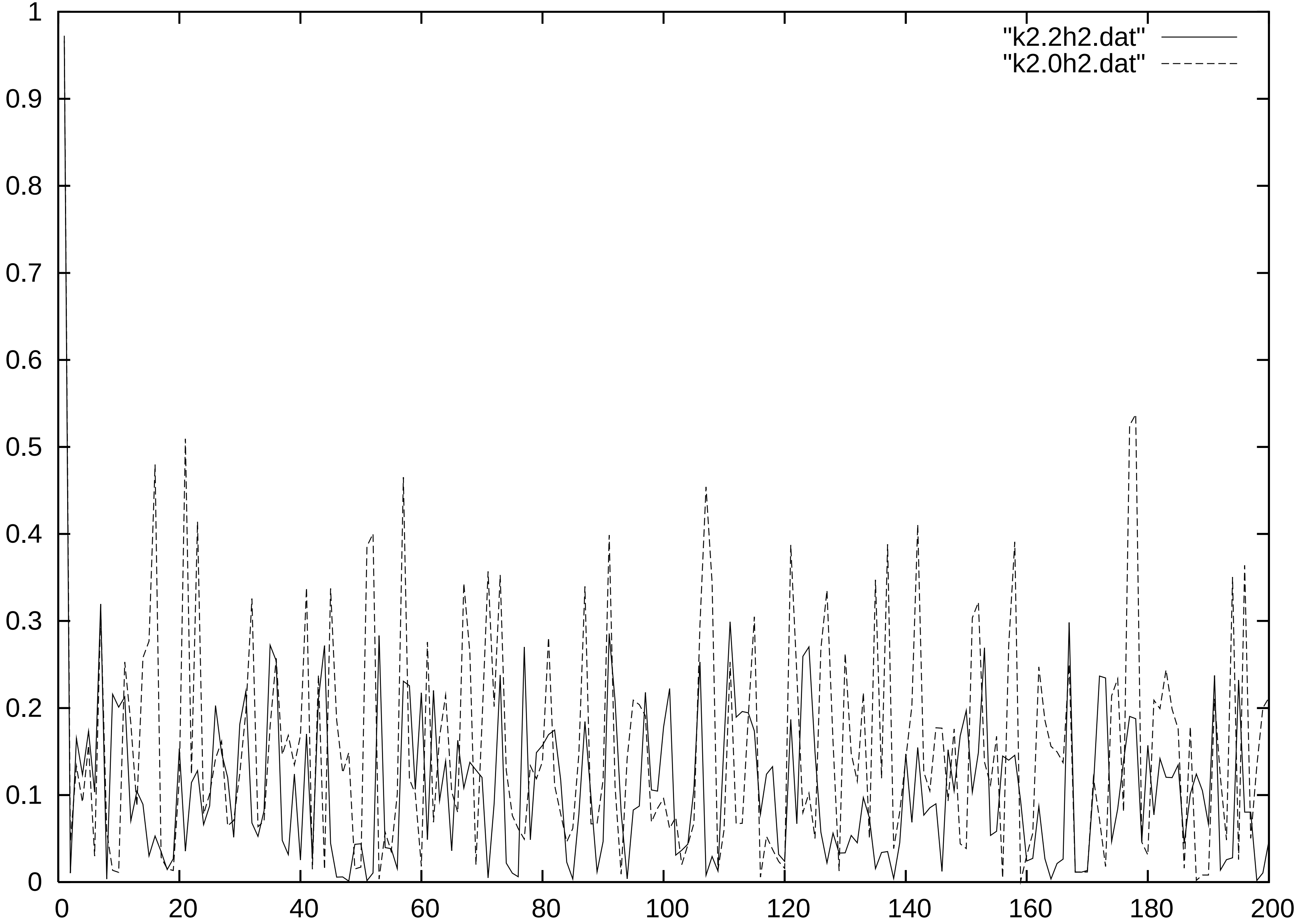

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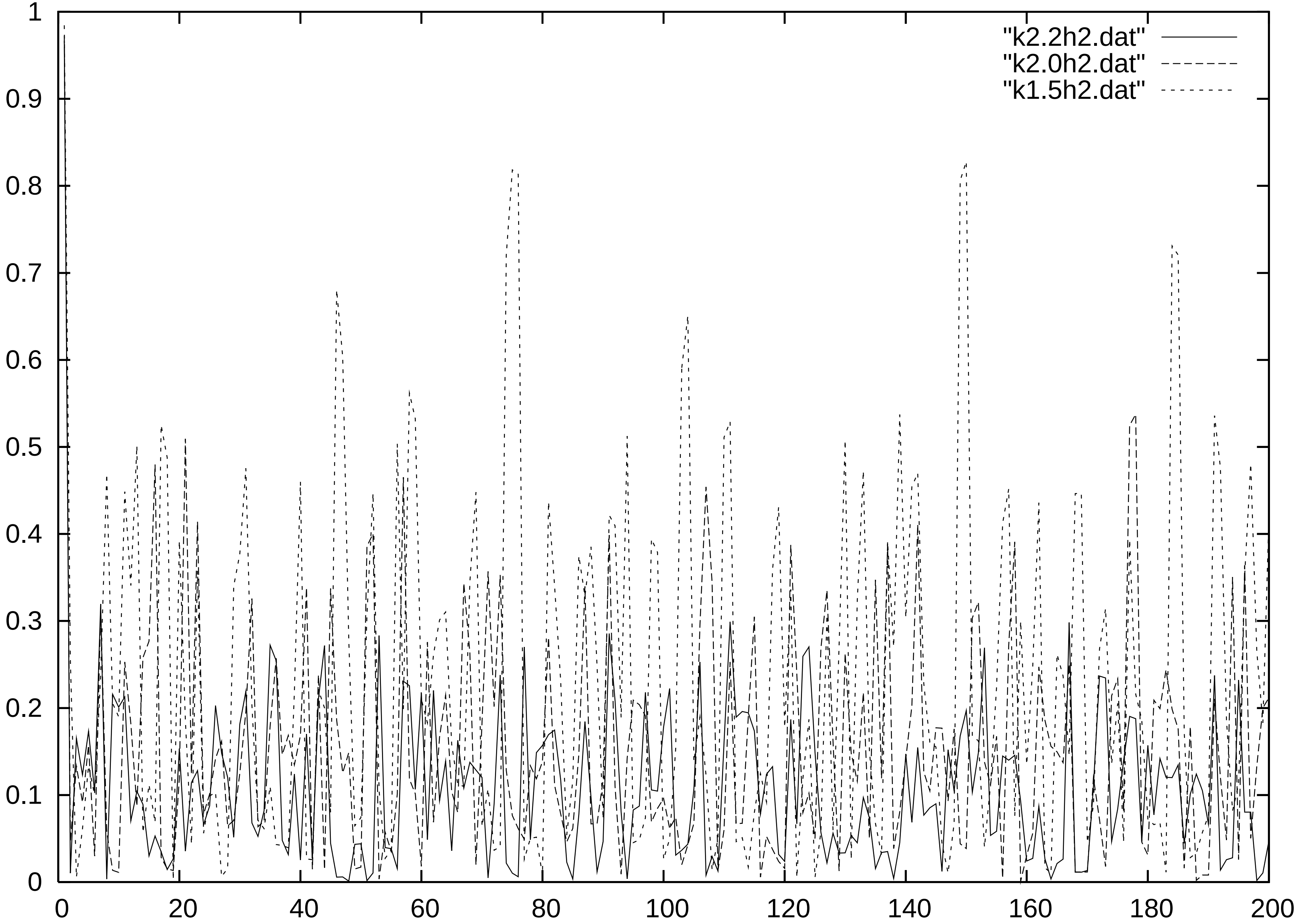
"k2.2h2.dat"
"k2.0h2.dat"
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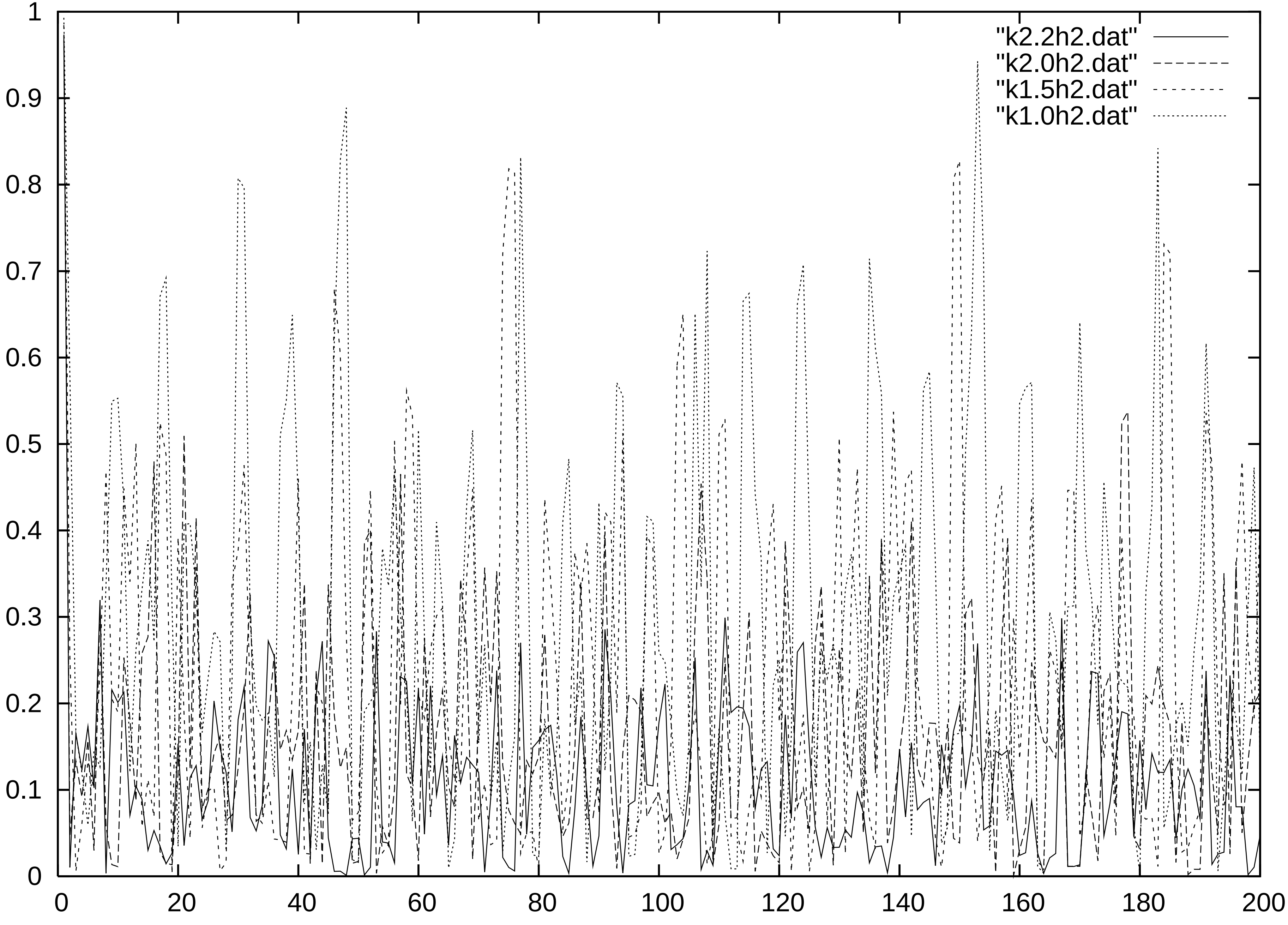

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"k2.0h2.dat"
"k1.5h2.dat"
"k1.0h2.dat"
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