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Bridging the gap between natural & artificial light-harvesting : a structure-function investigation with MAS NMR

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**Bridging the gap between
Natural & Artificial Light-Harvesting**

A structure-function investigation with MAS NMR

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Bridging the gap between Natural & Artificial Light-Harvesting

A structure-function investigation with MAS NMR

PROEFSCHRIFT

ter verkrijging van de graad van Doctor
aan de Universiteit Leiden,
op gezag van de Rector Magnificus Prof. Mr. P. F. van der Heijden,
volgens besluit van het College voor Promoties
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door

Swapna Ganapathy

geboren te Vancouver, Canada in 1980

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Prof. dr. J. Lugtenburg
Prof. dr. J. Brouwer

For my parents

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Abbreviations

[E,E]	[8-ethyl, 12-ethyl]
[E,M]	[8-ethyl, 12-methyl]
[M,M]	[8-methyl, 12-methyl]
[Pr,E]	[8-propyl, 12-ethyl]
1D	one-dimensional
2D	two-dimensional
AFM	atomic force microscopy
BChl	bacteriochlorophyll
<i>bchQR</i>	<i>bchQ bchR</i>
<i>bchQRU</i>	<i>bchQ bchR bchU</i>
BLYP	Becke, Lee, Yang and Parr
<i>C.</i>	<i>Chlorobium</i>
<i>Cf.</i>	<i>Chloroflexus</i>
Chl	chlorophyll
COSY	correlation spectroscopy
CP	cross-polarization
DARR	dipolar-assisted rotational resonance
DFT	density functional theory
EM	electron microscopy
FMO	Fenna-Matthew-Olson
FSLG	frequency-switched Lee-Goldburg
GIAO	Gauge-Independent Atomic Orbital
HETCOR	heteronuclear correlation
HOPG	highly ordered pyrolytic graphite
HRMS	high resolution mass spectrometry
LH1	light-harvesting complex 1
LH2	light-harvesting complex 2
MAS	magic angle spinning
NICS	nucleus-independent chemical shift
NMR	nuclear magnetic resonance
NSD	normal-coordinate structural decomposition
OD	optical density
PDB	protein data bank
PDSD	proton driven spin diffusion
PMLG	phase-modulated Lee-Goldburg
ppm	parts per million
RC	reaction center

Abbreviations

<i>rf</i>	radio frequency
RFDR	radio frequency-driven dipolar recoupling
<i>Rps.</i>	<i>Rhodopseudomonas</i>
S/N	signal-to-noise
STM	scanning tunneling microscopy
THF	tetrahydrofuran
TPPM	two pulse-phase modulation
<i>w</i> PMLG	windowed phase-modulated Lee-Goldburg
WT	wild-type

Amino acid abbreviations

A	Alanine
R	Arginine
N	Asparagine
D	Aspartic acid (Aspartate)
C	Cysteine
Q	Glutamine
E	Glutamic acid (Glutamate)
G	Glycine
H	Histidine
I	Isoleucine
L	Leucine
K	Lysine
M	Methionine
F	Phenylalanine
P	Proline
S	Serine
T	Threonine
W	Tryptophan
Y	Tyrosine
V	Valine

